59 a 10

(Vr.)

K

STORER's
Syllabus,
TO
A COURSE
OF
Optical Experiments,
ON THE
Syllepſis Optica,
OR THE
NEW OPTICAL PRINCIPLES
OF THE
Royal Delineator
analyſed.

In hoc ſigno ſpes mea.
In veritate victoria.

Signed W Store

For His Majesty

G.R. III.
BRITISH MUSEUM

Almac de Goëttinger pour l'annee, 1779, *page* 91.

“LA *conſidérable amélioration* qui a été donnée en Angleterre, à la chambre obſcure par un artiſan dont nous ignorons le nom, eſt à préſent conſtatée. Un grand ſcrutateur de la nature qui l'a vue, nous en a fait un raport de bouche. Elle repréſente les objets avec la derniere perſpicuïté et très-diſtinctement, qu'ils ſoient proches ou éloignés. Pendant que la rue ſe repréſentoit parfaitement bien, l'image d'un grand tableau de Van Dyck, qui pendoit dans la chambre où ſe trouvoit l'inſtrument, ſe voyoit peint ſi clairement et ſi expreſſivement, qu'on eût cru voir la plus fine peinture d'un portrait en mignature. On ne put alors rien remarquer de particulier dans la diſpoſition, ſinon que la plaque de verre non polie par derriere, ſur laquelle ſe peignoit l'image repoſoit immédiatement ſur un grand verre convexe.”

I FEEL MYSELF ſo highly honoured, *by my real* PATRONS, that, as a teſtimony of gratitude, I recommend to *their* peruſal, and the candour of the PUBLIC, *a Syllabus*, ſetting forth the nature of my diſcoveries, and the particulars of the optical inſtruments the public may expect to be ſupplied with, under proper protection, ſubmitting how neceſſary it is to publiſh ſome *new* Optical Principles, *by which* the moſt complex ideas on that ſcience will be removed, and the ſimplicity of the cauſes of many optical effects and phœnomena ſo familiarized, as I truſt and hope will be a means of optics in general, *receiving ſtill greater improvement when laid before the public*, than can be expected from the life, practice, or confined abilities, under the various oppreſſions which every ſingle perſon is ſubject to, who ſtrikes out any thing new, however valuable.

It is not very uncommon for men who are miſled, to be partially partial.

The liberal public, overlooking this malady, is conducive of many bad effects, particularly when *perſons of ſome kind of rank* through miſtake, depend too much on ſuch indulgencies, uſe the extremes, and force themſelves upon us, ſuppoſing they are authoriſed to take any liberty with the truth.

I confeſs a partiality to things wherein theory and practice *in good cauſes* agree, I delight in ſimple modes of making experiments, as I have hitherto found them moſt ſucceſsful, perhaps I over enjoyed any new effect that occurred; for as I diſcovered them, I imparted the ſame, and no ſooner was a hint given, but it was handed about, and (as a ſnow ball) ſoon gathered oppoſites to its own element, which gave riſe to many abſurdities.

IN future, to prevent and remove errors which I might be liable to, I preferred ſubmitting my works to the candour and report of *an honourable committee of perſons of the firſt rank*, as truſtees to the public, *who* have been pleaſed to condeſcend to the ſame, and to report their opinion thereof; this work is accordingly wholly ſubject to the direction of an HONOURABLE COMMITTEE.

THE public are hereby informed, *this is the firſt committee that has been preferred to inſpect my works*, and that the committee ſaid to be appointed (by authority of parliament) was a miſtake of the gentlemen *who* attended on me about that buſineſs, as the honourable houſe had not reſolved on a committee for that purpoſe, as will appear.

FOLLOWING this *Syllabus* are comprized the heads of every printed particular that I have given out, and every pretenſion I ever had to optical diſcoveries and improvements, by comparing which with my experiments and inſtruments, will enable the Honourable Committee, and the Public in general, to determine (in what degree) ſhould I fall ſhort, or exceed my promiſes.

To which is added a liſt of ſuch as have done me the honour of paying in their half ſubſcription to my Teleſcope, *&c.* and ſome other particulars, which I hope will juſtify me in having been more reſerved than my ſubſcribers and the public might think neceſſary, after having deſired, and in part received their ſupport, to whom I am

Their thankful,
Obedient humble ſervant,

W. STORER.

Preſt pour mon pais.
Verité ſans peur.

TO

JOHN PITT, Eſq;

Moſt kind Sir,

YOUR unaffected humanity, and generous hoſpitality, acquires freſh luſtre, and claims a higher reſpect from me, who can judge of it, by having felt your perfomance of actions, worthy of the greateſt applauſe, and yet declined the praiſes juſtly due to them.

Your indefatigable attention to, and honorable acceptance of, my poor labours, has engraved a ſenſe of your goodneſs on my heart, which cannot be requited by any words I am able to expreſs my gratitude by.

To gratify you, in whatever you may deſire of me, is ſo inadequate to the noble and kind reception and ſupport I have experienced, that no conſideration could diſpenſe with my giving you every ſatisfaction; and, although I have had reaſon to conceal my diſcoveries, and the ungenerous treatment I have met with from ſome perſons, it ſtill would be unpardonable in me not to publiſh a work, which, I truſt, will be uſeful and proper to clear up ſome points, in behalf of which, you have intereſted yourſelf ſo much.

The confidence I placed in your advice and ſupport, and on whoſe wiſdom and honor I have ever depended, added to your noble diſpoſition to do juſtice, and regard truth, gives me ground to hope; and the inclination I find in myſelf to have your protection, and to deſerve it to the utmoſt of my power, induces me to deſire you will gratify me, ſo far, as to excuſe the liberty of addreſſing this *Syllabus* (to a courſe of experiments made by me on the *Syllepſis Optica*) to *you* who gave it birth; a performance, in which, I hope, to give ſuch pleaſure and ſatisfaction, as, I truſt, your goodneſs muſt take in the recital of juſtice done to my injured truths.

For, ſhould my attempts be found to be of the leaſt advantage to mankind, I feel it indiſpenſibly incumbent on me, not to ſuffer to eſcape, from the public, the knowledge of the perſons to whom they are moſt infinitely obliged for them; and having no other power of expreſſing my gratitude, but that, of a moſt ardent wiſh for an opportunity to diſcloſe my diſcoveries, *under your's, and my Patron's directions*, in which, I ſhall not only inviolably perform every condition, that, from time to time, I may have the high honour to have impoſed upon me by them; but ſhall ever uſe my utmoſt diligence to ſhew a mind capable of *reſenting* the many obligations conferred upon me, by preſerving the greateſt accuracy in my works, annexed to the ſtricteſt attention, and obedience to the truth of experiments.

It is with the utmoſt reſpect and deference I ſubſcribe myſelf,

Sir,

Your much honoured,

and

Obliged humble ſervant,

London,
1ſt Dec. 1782.

W. STORER.

Profeſſor of Opticks to his Majeſty.

HAD I read the hiſtory and preſent ſtate of diſcoveries, relating to *Viſion, Light, and Colours,* (publiſhed by the Rev. Dr. PRIESTLY, in the year 1772) before I had recourſe *to experiments,* I confeſs I might have been ſatisfied with the principles and demonſtrations there laid down.

That valuable treatiſe contains ſo much ſound reaſoning, and ſo many deſirable hints towards the improvement of Optical Science, that I am perſuaded Dr. PRIESTLY only wanted to have made, or ſeen *more experiments* to have diſcovered, that there were *more additional principles required,* and neceſſarily exiſting, to render the *deſiderata* and *Phænomena* of *Optics, Light, and Colours, perfectly ſimple* and conſpicuous to any reaſonable capacity.

As ſuch, I cannot account for my own undertaking more to the preſent purpoſe, than by addreſſing myſelf to the public, in the Rev. Doctor's own words, in the preface to his aforeſaid work, *volume the Iſt, page* 4.

"A man muſt have had little ex-
" perience of life, and have acquired
" very little ſtrength of mind indeed,
" to be diverted from an undertaking,
" which he believes to be uſeful and
" important to mankind, on account
" of trifling, unjuſt, or unreaſonable
" cenſure."

Notwithſtanding the great advantages we have received from Sir ISAAC NEWTON, Dr. SMITH, Dr. PRIESTLY, and other eminent Profeſſors, the ſcience, application and uſe of Optics, are inconteſtibly in their infant ſtate, upon which occaſion, conſidering the truſt and confidence that has been repoſed in me, by the ſubſcribers to the *Pocket Teleſcope*, the reſpect I owe to thoſe who purchaſed the *Royal accurate Patent Delineator*, in its firſt ſtate, and *patronized, as I now am*, I find it indiſpenſibly neceſſary and incumbent on *me* to make known my *leading principles* on Optical Science, *at leaſt* ſo far as ſhall be neceſſary to facilitate the uſe of the *Royal Delineator*, ſhewing the great improvements *I have made* on that inſtrument, having now, rendered it perfectly *proper* to reflect the images of objects at various diſtances, on a paper or canvas, *&c. at once*, to any ſize, larger or ſmaller, that may be required, with the greateſt accuracy, *all parts of the image repreſented at the ſame time, equally diſtinct*, and ſufficiently luminous for drawing, to the niceſt preciſion, when the ſun does not ſhine.

THE expence for this improvement *on the Delineator*, will not be ſo much as I expected, as a ſmaller inſtrument will anſwer every neceſſary purpoſe, as ſet forth by *me*; the only advantage of a large inſtrument over a ſmaller, is that of the image being repreſented *more luminous*, but not more accurate.

The following, is a copy of a deſcription of the *Royal Patent Delineator*, wrote by that *high* and juſtly diſtinguiſhed *noble* character, *as judge and patron of the Arts*, the Honourable HORACE WALPOLE, and from *whom* I had the honour to receive it, to preſent to Sir JOSHUA REYNOLDS to correct, *who* was pleaſed to return it me, ſaying, it appeared to *him* to want no alteration.

" *The Delineator*,

" An Inſtrument

" THAT *obviates the defects* of the Ca-
" mera Obſcura, as it does *not* require
" the Sun to ſhine on the objects re-
" preſented, as it repreſents the objects
" erect, and neither inverted nor tranſ-
" verſed; as it is equally fit to be uſed
" *by candle light* as by day light; as
" it delineates the human face *of any*
" *ſize required*, and conſequently is of
" the greateſt uſe to portrait painters;
" as it gives the inſides of rooms and
" buildings *in the utmoſt exactneſs*,
" and their perſpectives; and that the
" rooms in which it is employed *need*
" *not be darkened*; as it exhibits land-
" ſcapes with the utmoſt *truth*, and even
" the foliage of trees, *with the niceſt*
" *preciſion*.

" *This inſtrument* will enable En-
" gravers to take drawings from Pic-
" tures,

“ tures, *with infallible accuracy*; and “ by *it*, not only the buſts and vaſes “ may be taken in few minutes, but “ even the patterns on thoſe vaſes or “ baſs-reliefs, may be copied as ſuc- “ ceſsfully.

“ *The inventor* is afraid of ſpecify- “ ing too many properties of his diſco- “ very, and is rather deſirous, that the “ various uſes to which it may be ap- “ plied, ſhould ſpeak its merit, and “ he ſhall feel more ſatisfaction in “ having the arts improved *in his own* “ *country*, by this uſeful inſtrument, “ than ambitious of perſonal fame. And “ leſt any neighbouring nation ſhould “ *hereafter* conteſt the improvement “ with *England*, he takes the liberty of “ ſpecifying the æra of the diſcovery.

“ *The idea* firſt occurred *to the inven-* “ *tor*, WILLIAM STORER, of *Saham* “ *Toney*, near *Swaffham*, in *Norfolk*, “ about the beginning of the year 1776, “ and was brought to its preſent ſtage

" of improvement, in about eigtheen " months.

" The inſtrument *would not be offered to the public*, if it had not the " *ſanction* of Sir JOSHUA REYNOLDS, " Mr. WEST, and other eminent pro- " feſſors.

" Sir JOSHUA REYNOLDS is begged " to correct this ſketch as he thinks " proper.

" HOR. WALPOLE,
" *Sept.* 19, 1777."

Theſe effects mentioned by Mr. WALPOLE, were *then* ſeen through the field glaſs, or repreſented on a rough ground glaſs, but are *by my laſt improvement*, as beforementioned, *now* repreſented as accurate and as beautiful *at once on paper or canvas, &c. &c.* to any ſize required, upon the invariable principles of *the Syllepſis Optica*.

I will evince the truth of this aſſertion to *thoſe* who have purchaſed the

Royal Patent Delineator, or ſhall produce a written order *from any of my Patrons*, to ſee the Experiment made, on their giving me a day's notice.

ANCIENT and abſurd prejudices ſtill ſubſiſt for want of more experiments, and more ſimple demonſtrations.

NOTWITHSTANDING I ſhall offer ſomething totally *different* to what has been laid down, neverthelecs *I will acknowledge proprieties*, and object to abſurdities, *with conſpicuity and firmneſs*.

The principles *I ſtart with*, I conſider *as my own*, depending upon neither *man* or *book* for them; I have drawn them, and my concluſions, from a regular courſe *of my own experiments* (which I will publiſh, *under certain conditions*) ſpecified in this *Syllabus*, unto which, reference being had will more fully appear.

THE *Rev. Dr.* PRIESTLY (in his firſt book of Optics, page the 2d,) amidſt his obſervations of the ancients, *ſays*,

" Miſtaken as the Platonic philo-
" ſophers were with reſpect to the
" progreſs of Viſion, I find that they
" were acquainted with two very im-
" portant obſervations concerning it,
" *viz.* That *light*, from whatever it
" proceeds, *is propagated in right lines*,
" and that when it is reflected from the
" ſurface of poliſhed bodies, *the angle*
" *of incidence is equal to the angle of*
" *reflexion*. Who it was that firſt made
" theſe important obſervations, is not
" known; but indeed, important as
" they are, and the foundation of a
" great part of even the preſent ſyſtem
" of Optics, it is poſſible that, if he
" were known, he might not be allow-
" ed to have any ſhare of merit, at leaſt
" for the former of them, the fact is ſo

“ very obvious, and ſo eaſily aſcertained.”

On the ſame grounds I conceived *my* diſcoveries and improvements on *Teleſcopes*, although of that importance, as to render *them* at leaſt *one fourth* more perfect, than has hitherto been known, (not excepting the beſt *acromatic* ever made by Mr. DOLLOND *on his lateſt improvement*, and at a *much* leſs expence, *owing to a greater certainty of the cauſes on which diſtinct Viſion depends*) might, nevertheleſs (as well as my other optical diſcoveries, *when made known*,) be found *too ſimple* to admit of any merit.

Indeed, *I have* no other claim than *that*, after a hint given to me by *Count de* BR'UHL, on ſeeing the ROYAL ACCURATE DELINEATOR, *His Excellency* recommended me to give ſome attention to *Teleſcopes*, ſuppoſing, a ſimilar cauſe that had led me to produce ſuch extraordinary effects, *as thoſe of the Delineator* might tend to the improvement *of Teleſcopes*, and *by purſuing experimentally, at a great expence, of money and time*, I obſerved an error of Mr. DOLLOND's, *in his acromatic Teleſcopes*, which, by the bye, would ſurprize any one, except modern philoſophers, who not having recourſe *to experiments*, are *more eaſily ſatisfied*, and ever ſubject to be impoſed upon.

This led me to examine Mr. DOLLOND's *ſpecification*, as enrolled in the *Petty-bag Office*; alſo an account to be found *in the Rev. Dr.* PRIESTLY's *Optics*, vol. 2d. page 456, on the ſubject *of the different diſperſion of the rays of light, as independant of their different refrangibility*; and, according to Mr. DOLLOND's new law, to correct the errors proceeding from the different refrangibility of the rays of light, *by his wedges*

wedges or priſms of glaſs, with different refractive powers, as laid before the Royal Society by Mr. Dollond; but what *I conſider* as a lame priſmatic hypotheſis, which, by *more acurate*, and *more ſimple experiments*, I find to be as remote from the true principles of Optics, *on which diſtinct Viſion depends*, as it is ingeniouſly complexed and *conſpicuouſly* abſurd.

It is evident *to me, however*, that Mr. Dollond muſt have conceived ſuch myſterious hypotheſis by chance, and, upon the whole, it is the beſt wrapt up, for ſo intricate a ſelf-deception, I have ever met with.

I am ſorry to add, that Mr. Dollond, (who I believe has merit,) diſcovered himſelf the moſt induſtrious, *by advancing it as an impoſſibility to improve Teleſcopes further than what he had already done*; ſure *it* was, at leaſt, *an unthinking*

thinking aſſertion, and *too much* for the *ableſt* of men. If the new law, which Mr. Dollond amuſed the *Royal Society* with, was, to the beſt of his judgment, *he could have been at no certainty of making a good Teleſcope*, or, more fully, *Teleſcopes of equal goodneſs, though, in every reſpect, with the ſame ſort of glaſs*; which demonſtrates, a *ſomething wanting*, to ſolve *many laughable, ſuppoſed*, or rather, *created phœnomena in acromatic Teleſcopes*, which, has not hitherto been accounted for; but *the Syllepſis Optica*, amidſt its various other uſes, will point out, in the cleareſt manner, *even to thoſe* who are at preſent entirely unacquainted with the Science of Optics; and, *as every optical inſtrument maker will become a Columbus*; *ſoon as I exhibit this part of the Syllepſis*, I humbly preſume to hope *the public in general*, as well as *my patrons*, will think *me* entitled to ſome kind of benefit *from my* *improvements*, in preference to their being practiced to my injury.

I feel an inexpreſſible ſatisfaction *in the ſimplicity and truth of my diſcoveries*, and think, it can never be required of me to part with them, without ſome foundation on which I may proceed ſecurely; and, *that I ſhall be countenanced, and properly ſupported* in ſuch degree *as my works ſhall be found deſirable and ſatisfactory*.

IT is ſcarce to be credited (after reflecting on the many advantages we have received from *Sir* ISAAC NEWTON, *and other eminent writers on the ſubject*) that the *deſiderata, relating to the laws of refraction, reflection, the refrangibility and inflexibility of the rays of light* (*optically conſidered*) ſhould *be ſo confuſedly jumbled together*, and, like lottery tickets in the wheel, *dwindled to almoſt empty chances*, which fact is obvious, by an *analyſis* made of Mr. DOLLOND's *acromatic Teleſcope,* and moſt other optical inſtruments (*as they are at preſent conſtructed*) convey a ſimilarity of abſurdities, *too ridiculous* to paſs unnoticed.

THE *Parliament, the Board of Longitude, the Board of Admiralty, the Royal Society, and the circle of Great Britain, produces many able Mathematicians,* ſeveral of *whom* I have had the high honour of communicating the nature of my diſcoveries to, and, *in whom* I will place all confidence with the higheſt eſteem.

SIR JOSEPH BANKS, *Preſident of the Royal Society,* the Aſtronomer Royal at *Flamſtead Houſe,* and particularly the Rev. Dr. SHEPHERD, being *one of the Board of Longitude, who, I underſtand, profeſſes Optics,* and others, *ought,* as unprejudiced men, to be awake to any uſeful diſcovery, *or the leaſt hint* that might tend *to improve Teleſcopes, and other deſiderata, to facilitate Navigation, Aſtronomy, Natural Hiſtory, or the Polite Arts,* to all of which *Optics juſtly claim the greateſt pretenſion.*

IF any of thoſe gentlemen, or any other perſons of rank, *have been miſlead,* by ignorant or deſigning men, *and ſtill retain the leaſt doubt, by not having had recourſe to ſufficient experiments themſelves,* they have now an opportunity (*by an honourable committee*) to call upon me publicly, *who will ſynthetically demonſtrate the truths of my allegations by the Syllepſis,* invented and prepared by me, *on purpoſe* to remove all objections in future.

I am ready to anſwer to every promiſe and engagement, *ſo far as depended on me,* whenever I may have the honour *to be properly called upon by my patrons,*

patrons, or thoſe of my ſubſcribers in my own country, or of any court in Europe.

I have *experimentally* and *cautiouſly analized* much Phœnomena, and thoſe effects, and combined powers of Optics, *relating to more acurate, more powerful, and more diſtinct Viſion, that has occurred to me,* and am prepared with the *Syntheſis.*

MY remarks on thoſe who have diſtinguiſhed themſelves moſt, as preſented to us by *the Rev. Dr.* PRIESTLEY, in his treatiſe on Optics, entitled, *The Hiſtory and preſent State of Diſcoveries, relating to Viſion, Light, and Colours*, pointing out many uſeful hints, by

Alhazen fl. 1072.	
R. Bacon d. 1292.	78.
Barrow d. 1677.	46.
E. Bartholin born 1625.	
Burgo fl. 1500.	
Bouguer d. 1756.	60.
Boyle d. 1691.	65.
Bradley d. 1762.	70.
J. Brahe d. 1601.	55.
Brandt fl. 1677.	
Campani d. af. 1678.	
Clairaut d. 1765.	53.
Deſcartes d. 1650.	54.
De Dominis d. 1625.	64.
Dolland d. 1761.	54.
De la Hire d. 1718.	78.
Du Fay d. 1728.	47.
Galileo d. 1742.	78.
Gaſcoigne d. abt. 1645.	
J. Gregory d. 1675.	35.
Grimaldi d. 1666.	
Hadley d. 1743.	61.
Haukſbee d. 1713.	
Hooke d. 1703.	67.
Huygens d. 1695.	66.
Janſen fl. 1590.	
Jurin d. 1749 about	70.
Kepler d. 1630.	58.
Kircher d. 1680.	79.
Leeuwenhoeck d. 1723.	91.
Lieberkhun d. 1757.	45.
Maraldi d. 1729.	64.
Marriotte d. 1684.	
Maurolycus d. 1575.	81.
Melville d. 1753.	27.
Muſſchenbroeck d. 1761.	69.
Newton d. 1727.	85.
Peccam fl. 1250.	
Petit d. 1741.	77.
B. Porta d. 1615.	
Porterfield d. 1768 about	70.
Rheita fl. 1620.	
Roemer d. 1710.	
S. Savery d. after 1743.	

Scheiner

Scheiner d. 1654.	89.
Short d. 1768.	58.
Snellius d. 1626.	35.
Smith d. 1768.	78
Tſchirnhauſen d. 1708.	57.
Vitellio fl. 1269.	
Ulbaldi fl. 1577.	

and others mentioned in Dr. PRIESTLEY's Hiſtory, *which I have read with great attention, and much pleaſure,* and will ſhew, in what manner my experiments agree, or differ *from thoſe mentioned in Dr.* PRIESTLEY'*s Hiſtory*, in every particular, that *hitherto* has occurred to me, to be uſeful, or improper.

CONSIDERING the vaſt choice of books *Dr.* PRIESTLEY *had recourſe to, to compile his hiſtory,* and for *other* reaſons, *by my own experiments,* I eſteem it the beſt authority extant, and, *I believe,* that by reading *Dr.* PRIESTLEY'*s hiſtory,* is, to be informed the *deſiderata* contained in all the books *the Doctor ſearched* on the ſubject, *beſides,* the advantage of the Doctor's own remarks, *many of which are admirable, and well worth attention.*

My remarks on *Dr*. PRIESTLEY'*s remarks*, in his hiſtory of Light, Colour, and Viſion.

My remarks on Mr. JOHN DOLLOND'S *ſpecification* of his compound Object Glaſſes.

My remarks on the controverſy between J. DOLLOND, M. EULER, M. KLINGENSTIERNA, of *Sweden*, M. CLAIRAUT, M. D'ALEMBERT, M. ZEICHER, of *Peterſburgh*, M. MURDOCK, *&c.* relating to the diſperſion of the Rays of Light, *viz. of the different diſperſion of the Rays of Light, as independent of their refrangibility*. See Dr. PRIESTLEY'S hiſtory *on Light, Colour, and Viſion*, vol. 2d. page 456.

AFTER having made infinite number of experiments, and laid out upwards of four thouſand pounds, in preparing models for my optical purſuits, *before* I read Dr. PRIESTLEY'S Hiſtory, Sir

ISAAC NEWTON's Optics, or Dr. SMITH's, that *they* became as familiar to me *as my own experiments*, to point out the errors, and benefit by the hints *therein contained*, ſome of which *had not occurred to me during my experiments*, but *which* I found competent to confirm *mine* (to my beſt belief) as *new*, *real*, and *uſeful* diſcoveries.

PARTICULARS.

OF the *Eye* in general, *ſo far as tends to Viſion*.

OF the *Muſcles* of the Eye, *uſeful for Viſion*.

OF the *Nerves* of the Eye, *uſeful to Viſion*.

OF *the Optic Nerve*.

OF the *Expanſion* of the Optic Nerve, *or Retina*.

Of the *Nigrum Pigmentum*, or *velvety* dark Coat, *and its great uſe to perfect Viſion.*

Of the *vitreous Humour* of the Eye, *and its uſe to perfect Viſion.*

Of the *chryſtaline Humour*, or *Lenſe* of the Eye, *and its uſe to perfect Viſion.*

Of the *aqueous Humour* of the Eye, *and its uſe to perfect Viſion.*

Of the *Iris* of the Eye, *and its uſe to perfect Viſion.*

Of the *Cornea* of the Eye, *and its uſe to perfect Viſion.*

Of the *Hair Laſh* of the Eye, *and its uſe to perfect Viſion.*

Of the *Choroid*, or *vaſcular Coat* of the Eye, *and its uſe to perfect Viſion.*

Of the *Sclerotica* of the Eye, *and its uſe to perfect Viſion.*

Of the *Aciliary Proceſs* of the Eye, *and its uſe to perfect Viſion.*

Of the *Coat of the chryſtaline Lenſe,* and its uſe *to perfect Viſion.*

Of the *Coat of the vitreous Humour,* and its uſe *to perfect Viſion.*

Of the *Artery in the Centre of the Optic Nerve of the Eye,* ſhewing its *proper* ſituation, as *it does not paſs through the centre of the vitreous humour,* (as ſome ſuppoſed) which muſt have been as great an obſtruction to diſtinct Viſion in the Eye *as, as large an opake vein would be in the centre of a lenſe of glaſs.*

Of the *optical* principles of the Eye, and *its alternate changes* being proper, and neceſſary conſequences *for diſtinct Viſion at different diſtances.*

Of the *manner* by which *Viſion* is performed by the Eye.

EXPERIMENTS

To know *when a perſon ought to uſe ſpectacles, and when not.*

EXPERIMENTS

To know *what ſort of ſpectacles ſuit the ſight beſt.*

EXPERIMENTS

SHEWING how *weak ſights may receive great relief, and that ſtrong ſights may be preſered by glaſſes.*

EXPERIMENTS

SHEWING *the great injury the Eye is liable to, by uſing improper ſpectacles,* which even ſometimes may occaſion perſons to loſe great part of their ſight, *but, by proper ſpectacles (or by glaſſes on a true principle) the ſight may be greatly aſſiſted.*

EXPERIMENTS

SHEWING that *convex, and concave glaſſes,* act *very differently* upon the *Eye* than what is generally ſuppoſed.

EXPERIMENTS

SHEWING *green-glaſs ſpectacles are very injurious to the ſight*, except when the eye is afflicted with *accidental* diſorders, *which rarely happen to one perſon in ten thouſand*; but, as I have *twice* been a witneſs to ſuch accidents happening, I ſhall explain the diſeaſes of the eye, in which *alone* green-glaſs ſpectacles may be uſed with ſafety.

SHORT-SIGHTED perſons relieved,—*how*.

LONG-SIGHTED perſons relieved,—*how*.

GOOD-SIGHTS preſerved,—*how*.

EXPERIMENTS

ON *a ſingle ray of light*, and *a ſingle lenſe* to the more compound, until all the *deſiderata* of Optics, *ſo far as is known*

known to me, ſhall be clearly demonſtrated.

EXPERIMENTS

On primary *direct* light, *or Viſion-making rays of light.*

EXPERIMENTS

On *ſecondary rays of light.*

EXPERIMENTS

On *direct, reflected rays of light.*

EXPERIMENTS

On *oblique, reflected rays of light.*

EXPERIMENTS

On *direct, tranſmitted rays of light.*

EXPERIMENTS

On *oblique, tranſmitted rays of light.*

EXPERIMENTS

On *refracted rays of light*, which I ſhall demonſtrate, are all (more or leſs) *priſmatic.*

EXPERIMENTS

Shewing the fallacy of the *acroamatic object glaſſes*, and of Teleſcopes *as they are at preſent conſtructed.*

EXPERIMENTS

Shewing *the vaſt improvements*, the *beſt* of Mr. Dollond's Teleſcopes are *yet* capable of.

EXPERIMENTS

Shewing the *curvature* of lenſes *properly made*, are the neceſſary conſequences of, *but no ways detrimental to, diſtinct Viſion*, as hitherto has been ſuppoſed.

EXPERIMENTS

SHEWING that Mr. DOLLOND's *ſpecification of his acroamatic Teleſcope* (as given in by him) *is diametrically oppoſite to the true principles of Optics*; for although the *refrangibility* of the rays of light are *in part* corrected *by that accidental combination*, ſtill their correction is owing to very different principles than *thoſe* given us *by the ſpecification of Mr*. DOLLOND; and I am now thoroughly convinced, *that Opticians in general are to this day, abſolutely unacquainted with the true cauſe, why Teleſcopes, by double or treble object glaſſes, are rendered better than refracting Teleſcopes which were made before*, and if Mr. DOLLOND *himſelf* had known the real cauſes of the diſeaſes of refracting Teleſcopes, *he certainly would have applied a more effectual remedy than he has.*

EXPERIMENTS

SHEWING *how* to rectify the miſtakes, or errors committed, in Mr. DOLLOND's *or the beſt acroamatic Teleſcopes as they are at preſent made,* which are glaring *abſurdities.*

EXPERIMENTS

TO *ſhew* the fallacy of ſome experiments made by Mr. JOHN DOLLOND, to correct the *aberrations* or errors *ſaid* to be occaſioned *by the ſpherical forms of lenſes.*

THE *apparatus,* to evince the truth of what Mr. DOLLOND wrote on this ſubject, *the Rev.* DOCTOR PRIESTLEY takes notice, *Mr.* DOLLOND *kept by him, in caſe it ſhould be required of him.* If *Mr.* P. DOLLOND has kept this apparatus of *Mr.* JOHN DOLLOND by him, it may be required of him to produce it; but ſhould it *chance* to be deſtroyed as ſuppoſing it out of uſe by the relapſed time, *Mr.* DOLLOND *will recollect, that honor and truth require no apology, never are out of date, though too often out of practice,* he therefore will do well to hold *himſelf* in readineſs, as he may expect to be *properly* called upon, *to evince the truth of his aſſertion,* like a man of *honor,* and *as a true philoſopher, who regards facts by experiments before authorities.*

EXPERIMENTS

To *ſhew* why *Mr.* DOLLOND's, or *Teleſcopes with double or treble object glaſſes are preferable to Teleſcopes made before.*

EXPERIMENTS

SHEWING that *Teleſcopes in general* may be made more portable, leſs complex, at half the expence, and to a much greater degree of perfection, *both as to their*

their magnifying powers, and better light, and with ſuch accuracy and *diſtinctneſs,* as is even beyond comprehenſion.

EXPERIMENTS

SHEWING many *abſurdities* committed *on the lateſt improved compound Microſcope.*

EXPERIMENTS

SHEWING *opera glaſſes, ſpectacles, reading glaſſes,* &c. &c. are capable of *great* improvement for the better aſſiſting the ſight.

EXPERIMENTS

ON the *Camera Obſcura,* ſhewing the true cauſe of the defects of that inſtrument *do not proceed from the curvature of a true lenſe* (as is ſuppoſed.)

EXPERIMENTS

ON the *Newtonian reflecting Teleſcope,* ſhewing *that inſtrument,* is capable of *great*

great improvement, and may be rendered *infinitely* more diſtinct, with greater magnifying powers, than have, with ſucceſs, been applied to it, or than can be uſed to the GREGORIAN or SHORT's *beſt Teleſcope*, owing to the conſtruction of the GREGORIAN *and* SHORT's *reflecting Teleſcope*, not being *near* ſo advantageous *for diſtinct Viſion* as the NEWTONIAN.

EXPERIMENTS

SHEWING *why we ſee better or eaſier with two eyes than one*, ſuppoſing them to be of equal goodneſs.

EXPERIMENTS

SHEWING that *the rays of light, coming immediately from the diſk of the Sun, ought not to be treated as falling parallel on lenſes*, being contrary to the *truth*, and which, *in all probability*, has led young practitioners on *Optical Science* into moſt egregious errors, for the much greater part of the *rays of light* proceeding from the diſk of the Sun, *fall obliquely on lenſes*, and therefore, *thoſe* ought not to be called or treated *as parallel rays*, which actually are *oblique*, and many of them *from the Sun's diſk*, are in a very conſiderable degree ſo.

EXPERIMENTS.

SHEWING the fallacy of an *ingenious experiment* made on the *Camera Obſcura*, at *the* ROYAL OBSERVATORY, at *Flamſtead Houſe*, where *a concave table* (of plaiſter) is placed to receive the image of external objects, in order (as is ſaid) *to correct the errors occaſioned by the curvature of the lenſe*; alſo ſhewing the diſtortion *ſo conſpicuous in that Camera*, proceeds from very different and more *ſimple* cauſes.

EXPERIMENTS.

SHEWING *that the images of external objects may be perfectly repreſented on a plain table*, and may be drawn to the lateſt accuracy, *of any ſize required*, demonſtrated by the *Syllepſis*

THE EXPERIMENTS made by me on the *Syllepſis* (which is portable and of a ſmall ſize) are the combined powers and effects of ſome *new optical principles*, that led me to deviſe the ROYAL *accurate* DELINEATOR, which, when properly directed *and underſtood*, will be found *to comprehend every effect in Optics, hitherto known*, or even hinted at, *as deſiderata*, by the PROFESSORS of that SCIENCE, and will produce ſolutions of many phœnomena, not yet accounted for, but a publication of my experiments, *how I made them*, and the effects to be produced, by means of *the Syllepſis*, will point out in the cleareſt manner.

When I firſt offered the *accurate* DELINEATOR, I was not aware, that the true principles of Optics were ſo *little* underſtood; I therefore firſt conſtructed that inſtrument *with combined powers* for different effects; but I ſoon diſcovered my miſtake; for the generality of people thought it ſo complex, that I found it neceſſary to render its conſtruction more ſimple, though (to a ſtudent in the Science of Optics) *leſs deſirable*.

OUT of fifty DELINEATORS, which I ſold *on the firſt conſtruction*, I had forty-ſix ſent me to alter; and the four *ſtill unaltered* are the following; *One* in the poſſeſſion of THE KING, *His Majeſty* chooſing not to part with the inſtrument on my firſt idea, but deſired to have the new improved ones alſo as I made them. The Earl of BUTE deſired to keep his unaltered; HIS EXCELLENCY PRINCE GALITZIN had likewiſe one ſent to him, *by my friend and patron* CHARLES GORE, ESQ.; from whom I received ſeveral accounts, *that the moſt ingenious Opticians* ABROAD *could not work the inſtrument*. I am informed alſo, *that one of theſe inſtruments* was preſented, and had the honour to be received into the *cabinet* of HIS SERENE HIGHNESS THE PRINCE STADTHOLDER. WHO IT WAS that did me *that honour*, to preſent my firſt attempt to HIS SERENE HIGHNESS, I cannot ſay, I only know I was favoured with a letter from LOUIS DE JONCOURT, Counſellor and Librarian to HIS SERENE HIGHNESS the PRINCE OF ORANGE, informing me, HIS SERENE HIGHNESS had received *The* ROYAL *accurate* DELINEATOR *into his cabinet*, and deſired inſtructions for the uſe of it; but I could not ſend directions to an inſtrument *which I did not, upon a certainty, know was made by my inſtruction*; for, juſt about that time, a Mr. SYKES, of *South Suffingham*,

ham, bought a Delineator of me, for the purpoſe (as I was informed) *to make and ſell* DELINEATORS *in France, under pretenſion of being the inventor*; and perhaps THE PRINCE STADTHOLDER'S *inſtrument* might be made by Mr. SYKES, who, without being acquainted with the true principles of Optics, could not give proper inſtructions for the uſe of it.

THE only reaſon *that I can give* for people making any *difficulty*, or denying *the poſſibility* of producing *what I have offered, is this,* they muſt be totally ſtrangers to the true principles of Optics, upon *which* the effects ſet forth *by me* depend.

To make myſelf better underſtood, I have divided the combined powers and effects of the ROYAL *accurate* DELINEATOR, by a *Syllepſis* or *Model,* by way of Analyſis of that inſtrument, in the twelve following parts, *viz.*

FIRST,

THE *Principia Optica.*

SECOND,

THE *Optica Magica.*

THIRD,

Iphiauxetic Microſcope, for *pellucia* objects.

FOURTH,

Iphiauxetic Microſcope, for *opake* objects.

FIFTH,

THE *Holomicroſcope.*

SIXTH,

A Solar Microſcope.

SEVENTH,

THE *Reconnoiterer.*

EIGHTH,

A Newtonian Scale.

NINTH,

A Night Teleſcope.

TENTH,

TENTH,

A Capital Portable Teleſcope.

A Catadioptric Paralleliſm.

TWELFTH,

ROYAL *accurate* DELINEATOR, both ſimple, *as now made*, and compound, *as at firſt made*.

To know the *principles* of the ROYAL *accurate Patent* DELINEATOR, *is to know the principles upon which* the effects, to be produced by all its above parts, *depend*.

THE ſcience of Optics may be compared *to the game of Whiſt*, for want of knowing the true principles of which, *that game* is moſtly *murdered*; ſo, to be acquainted with the true principles of *Optics*, is, *to be able to play with them*, without murdering the cauſes on which their effects depend, *or to which they are related*.

To facilitate OPTICAL EXPERIMENTS, I made the *Syllepſis*, or analiſed the ROYAL DELINEATOR, and conſtructed the models myſelf.

BY my experiments on the DELINEATOR, (of which *His Majeſty* has been graciouſly pleaſed to teſtify *his* approbation) I will ſhew *how* to produce all the various effects of that inſtrument that have occurred to me, (*many whereof* are at preſent unknown to the public.)

FIRST,

EXPERIMENTS on the firſt part of the DELINEATOR, which I call *The Principia Optica*, calculated to repreſent ſmall pictures, prints, *&c.* on a canvas or paper, *to any ſize required*, ſo diſtinctly and accurately, as to enable *any perſon* to take a perfect outline.

THIS INSTRUMENT may be uſed *when the ſun does not ſhine.*

N. B. The Principia Optica was exhibited, *for the firſt time,* at WILLIAM BLOUNT's, Eſq; (*Church-Row, Richmond)* on *Saturday* the 23d day of *June,* 1781, before HIS GRACE THE DUKE OF PORTLAND, JOHN PITT, ESQ; WILLIAM CODRINGTON, ESQ; WILLIA LOCK, ESQ; and CHARLES GORE, ESQ; *Patrons* to my optical inventions; *all of which Gentlemen* teſtified *their* approbation of the effects that day exhibited, by ſubſcribing their names for the SYLLEPSIS OPTICA *entire,* with leave *for public notice* to be given of the ſame.

SECOND,

EXPERIMENTS on the *Optica Magica,* or *ſecond* part of the ROYAL DELINEATOR, calculated to repreſent human, or any other figures, and views may be taken *from nature* to a ſcale *of any ſize*, with perfect truth and accuracy, which renders it of great uſe to the arts in general.

BY the uſe of *this part* of the DELINEATOR, may be repreſented *on any ſcale*, ſingle figures, placed in any attitude, or groups of figures ſo arranged and diſpoſed at pleaſure, as to be of great uſe to painters, and ſave them much time and ſtudy, in the compoſition of HISTORICAL or FAMILY PICTURES.

THIRD,

EXPERIMENTS on the *Iphiauxetic Microſcope*, with extraordinary magnifying powers, (or *third* part of the ROYAL DELINEATOR,) for viewing minute *pellucid* objects.

FOURTH,

EXPERIMENTS on the *Iphiauxetic Microſcope*, with equal magnifying powers, (being the *fourth* part of the ROYAL DELINEATOR,) for viewing minute *opake* objects.

FIFTH,

EXPERIMENTS on the *Holomicroſcope*, (or *fifth* part of the ROYAL DELINEATOR,) for viewing ſmall objects entire, for the uſe of NATURALISTS, BOTANISTS, MINIATURE PAINTERS, SEAL ENGRAVERS, MODELLERS, and CHASERS, in ſmall, which is alſo of great uſe for the examining of *gems*, *cameos*, *entaglios*, *coins*, &c. &c. It magnifies to a very great degree; and exhibits AT ONE VIEW, the entire figures of ſmall inſects, *&c. parts only of which*, and upon a much ſmaller ſcale, can be viewed by any inſtrument at preſent known.

SIXTH,

EXPERIMENTS on a *ſolar Microſcope*, (being the *ſixth* part of the ROYAL DELINEATOR,)

LINEATOR,) particularly uſeful to SURGEONS and BOTANISTS, for viewing parts of *human* and other animals, *plants*, *inſects*, &c. preferable for thoſe purpoſes, in a ſurpriſing degree, to any known inſtrument whatſoever.

SEVENTH,

EXPERIMENTS on the *Reconnoiterer*, (or *ſeventh* power of the ROYAL DELINEATOR,) which, with the addition of a tube only, (that may be uſed with great facility) will be found of great uſe, to ſee into TOWNS or FORTIFICATIONS at a conſiderable diſtance, giving the ſpectator an advantage equal to an elevation of forty feet, ſhould he think proper to apply ſuch a length of tube.

EIGHTH,

EXPERIMENTS on the *Newtonian Scale*, (or a ſcale of the ROYAL DELINEATOR,) founded on SIR ISAAC NEWTON's *principles*, neceſſary for adjuſting

ing the ROYAL DELINEATOR *ſylleptically*, in order to produce the beforementioned effects.

NINTH,

EXPERIMENTS on a *night Teleſcope*, (or *ninth* property of the ROYAL DELINEATOR,) *which will exhibit in the night objects inviſible to the naked eye*, with far greater powers than any night Teleſcope now in uſe.

TENTH,

EXPERIMENTS on a capital *portable Teleſcope*, being a *tenth* property, and, as a *criterion* of the truth and utility of the principles and properties of the DELINEATOR, is *recommended by me to my* PATRONS, *as a teſtimony of gratitude*.

ELEVENTH,

EXPERIMENTS on the *catadioptric Paralleliſm*, or principles of the ROYAL

DELINEATOR, *ſlightly* mentioned by me *in my Specification of new Optical Principles*, inrolled in HIS MAJESTY's *High Court of Chancery*, dated the tenth day of *Auguſt*, 1780; I ſay, *ſlightly mentioned*, becauſe *it does not concern the ſpecification, as a ſpecification*, otherwiſe, than being a kind of hiſtorical account of the *principles* upon which *the conſtruction of the ſpecification is founded*.

THE *catadioptric Paralleliſm* I offer, as leading to farther diſcoveries; and *which* I humbly recommend to the acceptance of my PATRONS, as a better explanation of the *acroamatic Teleſcope*, (which reflects great honour on MR. EULER, *who firſt occaſioned an enquiry into that improvement*) than has hitherto been laid before the public. THIS will confirm the validity of MR. EULER's reaſoning, in oppoſition to MR. DOLLOND's on the ſame ſubject, alſo ſhews the fallacy of the expeririments on the *wedges*, or combination of three priſms of glaſs, with *different* refractive powers, laid before the ROYAL SOCIETY by MR. DOLLOND, whoſe theory, experiments, and practice, want harmony, tending rather to confuſe than unfold the true principles of Optics, which are, in truth, far more ſimple and clear, if undiſguiſed.

AFTER all theſe experiments are demonſtrated by the SYLLEPSIS OPTICA, (*or reſervoir of the true principles of Optics*) it will appear, that the *Syllepſis* is no more than the combined powers and effects of *The* ROYAL *accurate patent* DELINEATOR, which HIS MAJESTY did me the high honour to receive and patroniſe in it's infant ſtate, but which I have ſince been ſo happy to *improve and ſimplify from that my firſt idea, as not only to facilitate its uſe, but that it may be better underſtood.*

I firſt called the combined powers of the DELINEATOR *Modela Optica Principia*, (or *Magazine of Optics*,) but afterwards more properly named, by JOHN PITT, ESQ.; *Syllepſis Optica*.

SYLLEPSIS, in grammar, *conceptio*, a figure whereby we conceive the ſenſe of words, otherwiſe than the words import; and *thus* make our conſtruction, not according to the words, but the intention of the author.

THE SYLLEPSIS, ſays an ingenious author, *is a figurative conſtruction*, which agrees rather with our ideas, than with words, and expreſſes rather the ſenſe of our mind, than the ſenſe of the term themſelves.

SYLLEPSIS, in this work, as conſidered by me, is a figure or model, *by which* facts may be proved *by experiment*, being more full than words can convey.

SYLLEPSIS is alſo here conſidered, *as an aſſemblage of truths by experiment*, or reſervoir to repair to, when matter for a ſubject or ſcience is exhauſted, or injudiciouſly treated, alſo to ſupply the deficiencies of comprehenſion.

THE effect produced by *the Syllepſis*, furniſhes the mind with a kind of intuitive knowledge, ſuch as when a ſubject or ſcience is miſunderſtood, or miſrepreſented, is, beyond conception, paſt belief, *then* the *Syllepſis* ſteps in, and demonſtrates by experiment.

THIS property of the *Syllepſis* ſuits me perfectly well, as I have no time to loſe, and to coin words might perplex me and the public, nor can I deviſe any mode of properly explaining *my diſcoveries and improvements*, but by a publication of the experiments *made by me on the Syllepſis*, and expoſing the beforementioned

mentioned inſtruments to ſale, as it may ſuit me, agreeable to the demand there may be for them, or to any ſupport I may have the honour to receive in future.

DEFINITIONS.

DEFINITION I.

I Conſider *rays of light* as primary, ſecondary, and caſual. By a *primary ray of light*, I would be underſtood a ray of *light* that is propagated *in a right line* from the ſun, or from a candle or luminous body, to the body illuminated by it, *without ſuffering any refraction or reflexion, until it reach the body which it is meant to illumine.*

By *a ſecondary ray of light*, I mean a ray of *light* that is propagated from the illuminated body *in a right line, without ſuffering any refraction or reflexion, until it falls upon the ſecond body.*

By *caſual rays of light*, I wiſh to be underſtood thoſe rays of *light* which are propagated from bodies *in all directions.*

By the continual action of *caſual rays of light* from one illuminated body to another, and, which great alternate *action of* the rays of *light* proceeding from illuminated bodies, illuminate other bodies, *and each illuminated body* partaking of the tint or colour of one another, *infinitum*, produces thoſe moſt beautiful incomparable effects of nature which painters call *harmony*, and that often delight us ſo much beyond what words can expreſs.

By the laws of reflection, *light* is not only preſerved, but there is alſo *an increaſe of light created by the effects of the caſual rays of light*, more than equal to the primary light of the ſun; thus does *the great law of reflection* take place of all other laws in optics.

DEFINITION II.

BESIDES the *primary*, the *ſecondary*, and the *caſual* rays of light, there are alſo *viſion-making* rays of light, *viz.* PRIMARY *viſion-making* rays of light, SECONDARY *viſion-making* rays of light, and CASUAL *viſion-making* rays of light.

BY *viſion-making rays of light*, I mean thoſe rays of light *only*, which produce to our ſenſes the idea of *a diſtinct image of any part of an object that is preſented to our view*, or by which we diſcern the image of an object more or leſs diſtinct, according to its diſtance or magnitude; agreeable to the laws of perſpective, *ſuffering no refraction by the medium it paſſes through, of whatever denſity or form.*

SECONDARY *viſion-making rays of light* are thoſe rays coming from an illuminated ed unpoliſhed object, or having fallen on an opake poliſhed body, ſuch as metals, or the like, or glaſs, or pellucid bodies, ſuch as fluids, whether plain, angular, convex, concave, cylindrical, conical, or parabolical, or any other figure, *and from thence, properly reflected, or tranſmitted, to any other body, without ſuffering any refraction.*

By CASUAL *viſion-making rays*, I would ſay thoſe rays of light which are propagated *in right lines* from any point of an illuminated object of any colour or form, after being reflected by poliſhed bodies, or tranſmitted through pellucid bodies of any denſity or ſhape, (proper to produce true images of external objects) *by the laws of reflection and tranſmiſſion*, ſuch as are received *on the retina of the eye*, or, on a wall, canvas, paper, or the like, by means of mirrors, lenſes, *&c. without ſuffering refraction or diſtortion.*

Vision-making *rays of light ſuffer no refraction, viz.* a ray of light ſuffering refraction, produces priſmatic colours, *and impedes diſtinct viſion.*

All refracted rays of light are more or leſs *priſmatic*, and are the neceſſary conſequences *of the priſm*, but *diametrically oppoſite to diſtinct viſion*, which, nevertheleſs, may be produced *by my new laws of tranſmiſſion through, and reflection by, refracting medium.*

Most probably Sir Isaac Newton *diſcovered ſomething of this law of reflection*, yet, poſſibly the number of errors that great philosopher muſt have diſcovered *in the refracted light*, during his experiments, (*and not having leiſure to do every thing*)prevented his putting in practice what in reality, or in great part, he had performed, and which hint of Sir Isaac Newton's, as Doctor Priestley mentions, was firſt improved upon by Mr. EULER, and then by Mr. DOLLOND; but I muſt add, it was *without knowing the principles*, as will appear by the Syllepſis Optica.

DEFINITION III.

THERE are alſo *priſm-making* rays of light, *viz.* PRIMARY *priſm-making* rays of light, SECONDARY *priſm-making* rays of light, and CASUAL *priſm-making* rays of light.

BY *priſm-making rays of light*, I mean *refracted* rays of light, *viz.* rays of light which are *broken* or bent out of their right *courſe* by various obſtructions, during their paſſage out of one medium into another, *being diverted from a right line with the incident ray by the laws of refraction.*

THESE PRISM-MAKING *rays* are very numerous, and proceed from, and are the neceſſary conſequences, *of light, refracted through different irregular mediums.*

PRISM-MAKING *rays of light,* on their paſſage through different mediums, ſuffer more or leſs *refrangibility,* I mean, as they are more or leſs *refracted,* they are more or leſs *priſmatic,* and, on the reverſe, VISION-MAKING *rays of light* ſuffer *no refraction whatever,* by their paſſage through rarer or denſer mediums; ſuch as glaſs, water, ſpirits, *&c. &c.* THUS, ſuppoſe a piece of glaſs is made the form of an equal double true convex lenſe, I obſerve a *viſion-making* ray of light paſſing through ſuch double convex lenſe *ſuffers no refraction,* but *continues* IN A RIGHT OR PARALLEL LINE WITH THE INCIDENT RAY *through the lenſe, until the image of the object from which it proceeds is formed,* but, in proportion to the *denſity* of the lenſe, *and the portions of the ſpheres of which*

which it is part together, according to the various directions, and different applications, ſo may rays of light be *lengthened*, or *ſhortened*, *converged* or *diverged* at pleaſure.

I likewiſe find theſe my new-diſcovered laws or properties of *light* and of *denſity*, and *forms* of glaſs or mirrors, ACT IN CONJUNCTION *with the laws of perſpective, reflexion and tranſmiſſion*.

BY THESE PRINCIPLES, admitting rays of light are propagated *in right lines*, and *that the angle of incidence is equal to the angle of reflection*, it follows, that *optical inſtruments* may be rendered perfectly ſimple, and be brought to any degree of perfection imaginable, even beyond comprehenſion or belief, both as to the *ſmallneſs* of their ſize, *diſtinctneſs of viſion*, *a ſufficiency of light*; and *greater magnifying powers* than can be credited *by thoſe*

thoſe unacquainted with theſe *unobſerved or neglected properties.*

BY VARIOUS EXPERIMENTS I obſerved *priſm-making* rays of light, and *viſion-making* rays of light, ought to be treated as depending upon *diſtinct principles,* quite *oppoſite* to each other, which led me to the following experiments, *ſubmitted to Mathematicians, and Philoſophers, as deſerving their attention for this moment.*

EXPERIMENT 1ſt.

FROM the above obſervation I concluded, *that rays of light from the ſun,* falling upon a *priſm* placed ſo, and *by which* the extreme rays would be refracted to given angles, that the priſm *then* being turned on its axis *backwards or forwards,* (within an angle agreeing with the given angles of the refracted rays) would not diſturb the priſmatic image received on a wall, paper, or the like, *viz.* "That the *image* of the refracted rays, *and their due order of colours*, (within the given angles) would remain undiſturbed OR STILL, at given diſtances, *though the priſm was moving on its axis*, but that the *viſion-making* rays AT THE SAME MOMENT *would be moving* agreeable to the laws of reflection; and, on making the experiment, I found it to be the reſult, and which reminded me of the following

EXPERIMENT 2d.

I conſidered the reverſe might happen on *viſion-making* rays, *viz.* " That an image formed by *viſion-making rays*, (treated according to my theory) after being tranſmitted through convex lenſes, *properly made*, and having formed the images of external objects on a wall, or paper at a diſtance at which the image ſhould appear moſt diſtinct; *that then*, though the lenſes ſhould be in motion, *the images* (produced by the *viſion-making* rays of light) would remain PERFECTLY STILL and UNDISTURBED

TURBED on the paper, or wall, but that the *priſm-making* rays of light would be moving AT THE SAME MOMENT agreeable to the laws of refraction, continually, producing new confuſions, by being diffuſed all over the images of the objects formed by the *viſion-making* rays of light, and on making the experiment, I found it was ſo, therefore my *ſecond* experiment anſwered equally to and with the former one.

BY THIS TIME I was convinced, that *priſm-making* rays of light, and *viſion-making* rays of light, were occaſioned *by two* DISTINCT *principles*, in direct *oppoſition*, and whenever improperly treated, deſtroyed each other, although they hitherto have been by OPTICIANS and MATHEMATICIANS, confuſedly jumbled together.

SUCCEEDING in theſe two experiments, and noticing that the effects of *priſm-making* rays of light, and the effects of *viſion-making* rays of light, proceeded from very oppoſite cauſes, (*viz.* I found the effects of *priſm-making* rays were produced by the laws of *refraction*, and thoſe of *viſion-making* rays by the known laws of *reflection*, even *though tranſmitted through* REFRACTING *mediums.*)

I thought of another experiment, by which the *priſm-making* rays of light, and the *viſion-making* rays of light, might be ſo ſeparated, *or ſo managed* as not to diſturb each other materially; for it appeared very viſible to me, that *priſm-making* rays of light, were only rays of light *wounded*; therefore, my next buſineſs was, to prevent the malady, and by many experiments I ſaw, it was eaſier to procure *fifty* new *viſion-making* rays of light, *than to mend one priſmatic one.*

WHILST making theſe experiments, I was encouraged by the utmoſt ſatisfaction, in finding *they perfectly anſwered to each other*, even beyond my fulleſt expectation; I then concluded the practicability of rendering to optical inſtruments, *any degree of perfection imaginable*, being convinced, that the *refrangibility* of the rays of light, was only the conſequence of rays of light *diſtorted or broken by refraction*; for light ſuffering the leaſt viſible *refraction* ſhews its *refrangibility*, and not till *then* becomes *priſmatic*.

BY THE LAWS OF REFLECTION *light* is not ſubject to the *priſmatic* diſeaſe, *unleſs* occaſioned by the ignorance or errors of workmen.

VISION-MAKING rays of light agree in every reſpect with the laws of *reflection*.

I now began to conſider in what manner rays of light would ſuffer, by being *tranſmitted* through A SOLID GLOBE OF GLASS; and, on making the experiment, I obſerved a ray of light proceeding from any one point of an object, in a direct line to the *axis* of THE SOLID GLOBE OF GLASS, formed two *perfect images, viz.* ONE *image* on *that* ſide the globe the ray entered, and ANOTHER *image* on the *other* ſide of the globe, *directly oppoſite each other,* at a diſtance from the globe, and at the ſame time, *I obſerved,* whilſt the two images, and incident rays were in right lines with each other, they were diſtinct and *free* from priſmatic colours, but, *with the leaſt variation,* the priſmatic enemy appeared, and increaſed *in proportion to the refraction or deviation from the incident rays,* agreeing with the order and colours of rays of light, *refracted through a priſm,* and, as explained by SIR ISAAC NEWTON's experiments *thereon,* the reſult of *which,* ſo far as they neceſſarily concerned me, *I have found to be ſufficiently accurate*, and that *the perfect image before the globe*, as well as that *tranſmitted through*, were *both* produced by the firſt law of *reflection*, *viz.* "A ray of light falling perpendicular-"ly on a plain poliſhed mirror, will be "reflected immediately back on itſelf." and it follows, if *one* part of A SOLID GLOBE OF GLASS returns, or *reflects* ſome of the rays of light, and ſuffers *ſome* of the rays to be *tranſmitted* AT THE SAME TIME, that the effects muſt be *ſimilar*, that are produced by the *ſimilar parts* of the ſame SOLID GLOBE OF GLASS (or other pellucid medium,) which *tranſmits* or *reflects* light in *ſimilar* directions; but to ſpeak fully and properly, is to ſay, *whilſt the tranſmitted or emergent ray be continued or terminate in a right line, or, parallel with the incident ray*, it is a perfect *viſion-making ray*, but on being *the leaſt refracted*, it becomes a *priſm-making* ray, *and improper* *for diſtinct viſion*; and this is true, as truth itſelf, *by experiment*.

NEVERTHELESS, after making theſe experiments, I was ſtill unwilling to give too much credit to my own new theory, *or even to the experiments* IN WHICH I HAD SO FAR SUCCEEDED, *until* I had made *further experiments in oppoſition to thoſe I before made*, in order *again* to prove them.

THERE are ſo many deceptions in optical effects, that even thoſe who think they are well acquainted with them, may be eaſily deceived; for until perſons can diveſt themſelves *of all prejudice*, and adhere *to facts only*, which, after every endeavour to entangle, will nevertheleſs be *free* and undiſturbed; I SAY, whilſt there is the leaſt ſhadow *of a doubt* hovering over any theory, or principle, or even experiments, *ſuch* theory, principle, or experiment, ought *not* to be pronounced, *but* *with ſuch exceptions* as may from time to time occur; I, therefore, not willing to deceive myſelf, or the public, *in ſuch an important undertaking*, thought it prudent, and *more ſafe*, to have recourſe *to further experiments*; and during theſe my reflections, a very remarkable idea preſented itſelf to my mind, *which was*,

THAT, if my theory was right, refracting Teleſcopes, conſtructed upon my principle, would admit of the eye-tube being bent various ways, (to different given angles,) as well as being ſtrait, and that ſuch bending or twining *would not diſturb diſtinct viſion*, nor occaſion priſmatic colours *any more* than when the glaſſes were *in a ſtrait line* (with each other) throughout the Teleſcope.

THIS EXPERIMENT I conſidered would be the ſtricteſt criterion that could offer; I therefore prepared a Teleſcope *with joints proper to bend* for various directions, and at widely different angles, *and I found the experiment agreed with my theory, and former experiments, to my fulleſt deſire*, as I could *bend it* in its whole length (which was about three feet) at leaſt *ſix inches* any way *out of a ſtrait line*, and that, *in its bent ſtate*, VISION was preſerved by it, *as accurate*, *as diſtinct*, and *as luminous*, as when the Teleſcope was in its *ſtrait* ſtate.

DON'T PRONOUNCE ME MAD, becauſe I ſay, *I did bend my Teleſcope without occaſioning the leaſt refraction of the rays of light from the incident ray*; HERE *pauſe a moment*, and coolly determine by experiment, *until then* to be *ſilent*, is to be moſt ſecure from being laughed at.

THIS TELESCOPE, which I have obſerved was about three feet long, was a remarkable good one; and after being ſatisfied myſelf, I ſhewed it *in its ſtrait and bent ſituation* to WILLIAM CODRINGTON, ESQ; and ſome few days after (on *Shooter's Hill*) I had the honour *to bend and twine* this pliable Teleſcope, to various angles, in the preſence of HIS GRACE THE DUKE OF PORTLAND, HIS EXCELLENCY COUNT DE BRUHLL, and WILLIAM CODRINGTON, ESQ; who ſaw through it *in its alternate bent and ſtrait ſtate.*

THE SAME TELESCOPE was alſo exhibited on the evening of the ſame day, before *the ſame Gentlemen*, at the above place, when it excelled, *in its greater light*, *with more diſtinctneſs*, and *greater magnifying powers*, than HIS EXCELLENCY'S *two foot reflector made by Mr.* MUDGE, and than other good Teleſcopes which were then tried againſt it. THIS TELESCOPE *had different*

ferent magnifying powers at pleaſure, and might be uſed with the greateſt facility.

THESE facts HIS GRACE THE DUKE OF PORTLAND, HIS EXCELLENCY COUNT DE BRUHLL, and WILLIAM CODRINGTON, ESQ; are acquainted with by ocular demonſtration, and *who* then did me the high honour to aſſure me, *they ſhould remember what I had ſhewn them.*

ON Mr. WILLIAM BLOUNT's being taken ill, I took this Teleſcope apart, with the reſt of my optical models and inſtruments, WHICH *I confuſed on purpoſe, to prevent any one's benefiting from my labours, during the many difficulties I foreſaw would unavoidably happen to me through Mr.* WILLIAM BLOUNT'*s indiſpoſition,* (at a time when I was no ways prepared for ſo ſudden a change.)

THIS kind of Teleſcope may be made at very variable prices, according to the powers required, and thoſe of the ſame goodneſs with the one I mention to have exhibited as above, may be ſold at the ſmall price of ſix guineas, yet they are better calculated for the army, or for the uſe of the ſea, than any at preſent known, and in miſty or hazy weather, particularly uſeful, and may be made to ſhut up portable for the pocket.

On the ſame new principles, Teleſcopes may be made to any degree of perfection imaginable, even beyond belief; and ſhould it be aſked, why I don't bring forth theſe Teleſcopes, *&c.* I anſwer, I wait but ſome greater certainty that I may proceed with ſafety, and that I ſhall not be interrupted in my optical purſuits, as I do not intend to riſk any hazard of being plundered of my diſcoveries or labours in future.

'TIS BY PARTICULAR DESIRE, *That* THOSE *who have denied the poſſibility*

bility of what I have offered, will not paſte up at their ſhop windows, or place on their ſhew-boards, NEW IMPROVED NIGHT TELESCOPES, or NEW IMPROVED OPTICAL INSTRUMENTS.

By various experiments, I have diſcovered Mr. Dollond's principles ARE FALSE, *in ſuch degree, as he acknowledges an difference of refraction neceſſary to produce the image of an object proper for diſtinct viſion,* or free from priſmatic colours ; what an unphiloſophical round about way then is Mr. Dollond's, *and how unpardonable, in any perſon,* to oppoſe diſcoveries, the nature of which they are yet unacquainted with, *and how unguarded,* to riſk their reputation in any oppoſition, by taking things *upon truſt,* which they may ſo eaſily ſatisfy themſelves with *by experiment.*

I would aſk any perſon, who wanted to go the ſhorteſt way from Mr. Dol-

LOND's houſe, in *St. Paul's Church-Yard*, to the *Royal Exchange*, if he would go through *Fleet-Street*, and ſo on round my houſe, in *Liſle-Street, Leiceſter-Fields*, inſtead of going through *Cheapſide* at once, unleſs he was unacquainted with the right road; and Mr. DOLLOND has abſolutely gone the moſt round-about, intricate, uncertain, and expenſive way, to cure the diſeaſes of Teleſcopes, which poſitively only exiſt through the ignorance or errors of workmen.

MR. DOLLOND gives another ſtrong proof of his being unacquainted with the true principles upon which diſtinct viſion depends, by applying a means to cloud, inſtead of clearing, the images of objects.

COMPOUND OBJECT GLASSES certainly do ſomething towards the improvement of Teleſcopes; but nevertheleſs Mr. DOLLOND has given the moſt convincing proofs, that *he* is perfectly unacquainted with the cauſe, and *this* is to a demonſtration confirmed, *both by his theory and practice*, which, as Mr. EULER juſtly obſerves, " is as " *contrary* to all the eſtabliſhed laws " of nature, as it is ſtrange and ſeem- " ingly abſurd," neither could Mr. EULER help expreſſing his ſurprize, " that Mr. DOLLOND ſhould have been " led to ſo important a diſcovery, *by* " *reaſoning in a manner quite contrary* " *to the nature of things*."

It ſeems to me, that Mr. DOLLOND only hit upon his improvement on Teleſcopes *accidentally*, but that, in reality, *he has not diſcovered any new principles in optics*, for his experiment (the account of which differs ſo widely from SIR ISAAC NEWTON's) I find to be contrary to the truth, and that the reſult of the ſame experiment made by

SIR ISAAC NEWTON, is the natural conſequence, and inconteſtibly agrees with the experiment on *the Syllepſis Optica*, as made by me, ſo far as it concerns the ſubject.

MATHEMATICIANS certainly are not aware of the vaſt importance of the hints firſt given by MR. EULER, *relating to the combination of object glaſſes, &c. &c. by which* Mr. DOLLOND has raiſed his fame, without a knowledge of the principles upon which their preference depends, and therefore like the bird that thought it knew how to build a whole neſt, *for want of further inſtructions, or ſounder principles, is forced to leave off half way*.

AT the time I was making theſe experiments on the Teleſcope, I had the honour to be viſited by LORD VISCOUNT MAHON, *in whom* I found both *the Judge* andthe *Patron*, HIS LORDSHIP

SHIP inſtantly ſubſcribed to my exhibition of experiments, and furniſhed me with many uſeful hints.

I ſoon diſcovered in HIS LORDSHIP, *the able Mathematician*, and regarded much his accurate method of enquiry; and *although*, at that time, it was not convenient for me to diſcloſe my principles on *Optical Science*, I ſtill confeſs I felt *ſuch great ſatisfaction*, in the knowledge of HIS LORDSHIP, that after a few viſits, I could not help writing a letter, of which the following is a copy.

"My Lord,

"The ſingular ſatisfaction I receiv-
"ed, when *you* honoured me with a
"ſecond viſit in *Liſle-Street,* in find-
"ing *your Lordſhip* (not only attached
"to, but) a better judge of the cauſes
"and conſequences of Optical Phœno-
"mena than I have hitherto met with,
"commands all my attention to *your*
"*Lordſhip*'s requeſt: it would be need-
"leſs to trouble *your Lordſhip* with any
"other reaſon, why *Philoſophers* have
"not underſtood each other, than that
"very few have been able to demon-
"ſtrate their principles, *as ſufficiently*
"*to prove they underſtood them them-*
"*ſelves*; and their ſilence at this junc-
"ture (or rather their denying the
"poſſibility of the truths now offered
"them) ſhew they were unacquainted
"what was more to be done, which has
"been my purſuit, beginning where
"Sir Isaac Newton appeared to
"have left off; and as I flatter myſelf

"my diſcoveries are really new lights, "that muſt tend to improve the ſcience "of Optics, *I likewiſe expect oppoſition* "*from the ignorant*; but reſting happy "in having juſtice done me by *your* "*Lordſhip*, and *ſuch* as have regard to "truth, am determined not to be chagrined by diſputes of deſigning men; "I therefore only offer my diſcoveries "to the favourable opinion of *impartial judges*, ſubmitting to *your Lordſhip* in what manner they deſerve to "be taken notice of: YOUR LORDSHIP "having peruſed my propoſal for the "monthly experiments, the following "are additions not yet made public, "neither can I reſolve to exhibit them, "unleſs ſome better proviſion is made. "Thoſe muſt have had little experience, and leſs ſtrength of mind, to "be diverted from an undertaking "which *your Lordſhip* is no ſtranger "to, muſt be of the greateſt importance, "and which, was it in my power,

" without injury to myſelf, I ſhould
" be the happieſt of men to make
" known; but my experiments and diſ-
" coveries have been, and ſtill muſt be
" attended with an expence, that would
" not be prudent to engage in, but with
" the ſanction and ſupport of my coun-
" try, and am, truſting in YOUR LORD-
" SHIP's approbation,

" My Lord,

" YOUR LORDSHIP'S

" Moſt humble ſervant,

" W. STORER."

" *P. S.* The field of view of Tele-
" ſcopes may be conſiderably increaſ-
" ed without priſmatic colours, *and*
" *without the acroamatic combination of*
" *glaſſes,*

" *glaſſes*. And Teleſcopes may be ſo " conſtructed, as that a ſmall fog ſhall " not prevent diſtinct viſion from an " object at a conſiderable diſtance: this " fact I proved by a ſmall model, about " five inches long, from my attic window, when the fog was ſo great, I " ſcarce could ſee the ſtones in the " ſtreet, but with my new-conſtructed " little Teleſcope could ſee a very ſmall " pin diſtinct, as if I had it in my hand; " and trying the experiment at more " diſtant objects, found it anſwered beyond my expectations.

" THIS phœnomenon led me to conſider its further uſe, whence I proved " to my ſatisfaction, that an object may " be magnified, and the medium diminiſhed at the ſame time *, by which

---

* *When I ſay, the object may be magnified, and the medium diminiſhed at the ſame time,* I ought to explain myſelf to the public, *thus*, *viz*. That an object may be magnified, *and the confuſion or opacity of a hazy medium diminiſhed*

" means that diſagreeable effect on the
" eye of the obſerver (as is uſual on
" looking through Teleſcopes) is ſo removed,
" as to excite a deſire to look
" longer, inſtead of wanting frequently
" to eaſe the eye.

" Much more may be done to improve
" the ſcience of Optics than I
" wiſh to ſay, unleſs the world were
" better acquainted with the phœnomena
" or deſiderata of optical ſcience,
" or till I have *your Lordſhip's* approbation
" to continue this ſubject."

By the above letter, I think it will appear I meant not to be reſerved, otherways than was prudent, *viz.* not to give up my diſcoveries, without ſome reimburſe-

---

diminiſhed at the ſame time; but I did not think it neceſſary to write ſo ſimply to Lord Mahon, as to thoſe unacquainted with natural phœnomena. Indeed I have been too ready to ſuppoſe the deſiderata of Optics were better underſtood; but in future I will write as I now believe, that very few people have a glimmering acquaintance with them.

reimburſement for the expences I had incurred on making my models for my experiments.

In a few days I had the honour of ſeeing Lord Mahon again, when I ſhowed *his Lordſhip* ſome optical effects, *who began to be impatient to know the principles I built upon*, and the next morning I had the honour to receive a letter from *his Lordſhip*, of which the following is a copy.

Harley-Street, Friday Night, 28th May, 1779.

" Sir,

" The more I reflect upon the effects " and principles which you have lately " ſhewn me, and upon the important " conſequences which are to be deriv- " ed from them, the more I am deſir- " ous of cauſing the merit of your diſ- " coveries to be made known to the " public. The great improvements you " have made in the ſcience of Optics, " are, of themſelves, of the moſt ſtri- " king utility to mankind in general; " but the conſiderable aſſiſtance which " may be derived from theſe diſcove- " ries, in determining the longitude, " and in the improvement of the art " of navigation, *&c.* make them of in- " finite conſequence to this country in " particular.

" I now think more than ever, that " Parliament ought to take this up,

" without one moment's loſs of time; " for every hour that is loſt in this buſineſs, is not only a loſs to you, but a " real loſs to the public; and I have " not the ſhadow of a doubt, that Parliament, if properly and ſpeedily applied to, will take this affair into immediate conſideration, and will grant " an handſome reward, on condition " of your making a full diſcovery of " all theſe things, to a proper committee appointed for the purpoſe: conſidering the vaſt importance of the " object, and conſidering the Royal " Patronage with which his Majeſty has been ſo graciouſly pleaſed to " honour your laudable undertaking.— " For my part, I ſhall be very willing, if called upon, to do you all the " juſtice in my power, either before " Parliament, or any other public body " in the kingdom; and I hope and " truſt, that it will never come to be " ſaid, that any foreign nation ſhould

" be the firſt to reap the benefit of your " valuable inventions; and that this " country, where (fortunately) they " have been diſcovered, ſhould let them " paſs unnoticed. I am,

" Sir,

" Your moſt obedient ſervant,

MAHON.

" *P. S.* I think that it is, however, " neceſſary to add, that I ſhall not be " able to do you all the ſervice I ſhould " wiſh, till I have ſeen your effects more " fully, and your principles more clear- " ly demonſtrated; for I have myſelf " ſuch a variety of important irons in the " fire, that I have not time to ſit down " to make out the mathematical de- " monſtrations of the cauſes of your ef- " fects, *&c.* as I was obliged to do this " morning, with reſpect to the prin- " ciple you mentioned to me yeſter- " day."

To Mr. *Storer*, *Liſle-Street.*

THE high honours conferred upon me for my firſt attempts (by THEIR MAJESTIES, HIS ROYAL HIGHNESS THE DUKE OF GLOUCESTER, ſeveral foreign PRINCES, and many NOBILITY and GENTRY, particularly the then LORD CHANCELLOR, EARL BATHURST, THE EARLS BUTE, HARCOURT and AYLESFORD, LORD VISCOUNT MAHON, THE RIGHT HONOURABLE SIR THOMAS SEWELL, *Maſter of the Rolls*, THE HONOURABLE HORACE WALPOLE, THE HONOURABLE THOMAS WALPOLE, JOHN PITT, ESQ; WILLIAM LOCK, ESQ; CHARLES GORE, ESQ; HIS EXCELLENCY COUNT BRUHL, and many others of the NOBILITY, SIR JOSHUA REYNOLDS, BENJAMIN WEST, ESQ; *Hiſtorical Painter to His Majeſty*, (and other eminent artiſts) created an emulation in my breaſt.

ENCOURAGED by *theſe* diſtinguiſhed NOBLE CHARACTERS, I ventured to proceed on my experiments, and being of opinion, notwithſtanding what I had diſcovered, yet (as the REVEREND DOCTOR PRIESTLEY obſerved, by the *platonic philoſophers*) in reality I could claim no ſhare of merit, *the facts were ſo very obvious, and ſo eaſily aſcertained*, but my buſineſs was to guard againſt loſing them, *and to prevent others aſcribing to themſelves a merit for diſcoveries which they had oppoſed*.

IT was as contrary to my feelings and wiſhes, *to refuſe my* FRIENDS, as it was neceſſary to exclude my OPPONENTS, and that was the moſt diſagreeable experiment I had to encounter with.

CONSIDERING *my experiments* on *the Syllepſis Optica*, are ſupported by the authority of SIR ISAAC NEWTON, MR. EULER, MR. MURDOCH, *&c. &c. I truſt the Public's enquiry will be general.* TO ALL NATIONS I APPEAL, was it only for the reſpect *juſtly due to* THOSE *indefatigable* EXPERIMENTAL PHILOSOPHERS. *Servata fides cineri.*

THE FOLLOWING ARE THE

HEADS

OF A

DISCOURSE,

ON THE

INVENTION AND IMPROVEMENTS

OF THE

Reflecting Teleſcope,

DELIVERED AT THE

ANNIVERSARY MEETING

OF THE

ROYAL SOCIETY,
November 30, 1777,

BY SIR JOHN PRINGLE, BARONET,
PRESIDENT.

PUBLISHED AT THEIR REQUEST.

LONDON:
Printed for the ROYAL SOCIETY, 1778,

of opinion, notwithſtanding what I had diſcovered, yet (as the REVEREND DOCTOR PRIESTLEY obſerved, by the *platonic philoſophers*) in reality I could claim no ſhare of merit, *the facts were ſo very obvious, and ſo eaſily aſcertained*, but my buſineſs was to guard againſt loſing them, *and to prevent others aſcribing to themſelves a merit for diſcoveries which they had oppoſed.*

IT was as contrary to my feelings and wiſhes, *to refuſe my* FRIENDS, as it was neceſſary to exclude my OPPONENTS, and that was the moſt diſagreeable experiment I had to encounter with.

CONSIDERING *my experiments* on *the Syllepſis Optica*, are ſupported by the authority of SIR ISAAC NEWTON, MR. EULER, MR. MURDOCH, *&c. &c. I truſt the Public's enquiry will be general.* TO ALL NATIONS I APPEAL, was it only for the reſpect *juſtly due to* THOSE *indefatigable* EXPERIMENTAL PHILOSOPHERS. *Servata fides cineri.*

THE FOLLOWING ARE THE

HEADS
OF A
DISCOURSE,
ON THE
INVENTION AND IMPROVEMENTS
OF THE
Reflecting Teleſcope,

DELIVERED AT THE
ANNIVERSARY MEETING
OF THE
ROYAL SOCIETY,
November 30, 1777,

By Sir JOHN PRINGLE, Baronet,
PRESIDENT.

PUBLISHED AT THEIR REQUEST.

LONDON:
Printed for the Royal Society, 1778,

“ GENTLEMEN,

“ IT was with equal truth and modeſty obſerved, by our moſt worthy brother, the REVEREND DOCTOR BRADLEY, (in his celebrated paper concerning the apparent motion of the fixed ſtars, and the cauſes of that deception) that the great exactneſs with which inſtruments are now conſtructed, hath enabled the Aſtronomers of the preſent age to diſcover ſeveral changes in the poſition of the heavenly bodies, *which, by reaſon of their ſmallneſs*, had eſcaped the notice of their predeceſſors [*]. And, indeed, it was upon this liberal principle, *the embracing of every aſſiſtance which could be advantageous to their inſtitution*, that this ſociety, from their foundation to this day, have cheriſhed the mechanical arts; nay, have often aſſociated thoſe artiſts that had invented or perfected inſtruments

---

[*] Phil. Tranſ. vol. 45.

" eminently conducive to the advance-
" ment of natural knowledge.

" IT muſt be acknowledged (ſays
" Dr. SMITH, in his complete Syſtem
" of Optics) that Mr. JAMES GRE-
" GORY of *Aberdeen*, was the firſt in-
" ventor of the REFLECTING TELE-
" SCOPE; but his conſtruction is quite
" different from SIR ISAAC NEW-
" TON's, *and not nearly ſo advanta-*
" *geous* *.

" GREGORY, a young man of an un-
" common genius, was led to the in-
" vention, in ſeeking to correct two
" imperfections of the common Tele-
" ſcope; the firſt was its too great
" length, which made it leſs manage-
" able; the ſecond, the incorrectneſs of
" the image. Mathematicians had de-
" monſtrated, that a pencil of rays
" could not be collected in a ſingle

---

* Remarks upon Art. 24.

“ point by a ſpherical lenſe; and alſo
“ that the image tranſmitted by ſuch a
“ lenſe would be in ſome degree incur-
“ vated. Theſe inconveniences, he be-
“ lieved, would be obviated, by ſubſti-
“ tuting for the object glaſs a metallic
“ ſpeculum, of a parabolic figure, to
“ receive the image, and to reflect it
“ towards a ſmall ſpeculum of the ſame
“ metal; this again was to return the
“ image to an eye-glaſs, placed be-
“ hind the great ſpeculum, which,
“ for that purpoſe, was to be perfora-
“ ted in its centre. This conſtruction
“ he publiſhed in 1663, in his *Optica*
“ *Promota*, a work which in every re-
“ ſpect doth honour to the author; but
“ as GREGORY, as he himſelf declares,
“ was endowed with no mechanical
“ dexterity, nor could find any work-
“ man capable of realizing his inven-
“ tion, after ſome fruitleſs attempts in
“ that way, he was obliged to give up
“ the purſuit: and, probably, had not
“ ſome

“ ſome new diſcoveries been made in
“ light and colours, a reflecting Tele-
“ ſcope would never more have been
“ thought of, conſidering the difficulty
“ of the execution, and the ſmall ad-
“ vantages that could accrue from it,
“ deduceable from the principles of
“ Optics that were then known.

“ But *NEWTON*, whoſe happy ge-
“ nius for experimental knowledge
“ was equal to that for geometry, and
“ who to theſe talents, in a ſupreme
“ degree, joined *patience* and mecha-
“ nical abilities; *NEWTON*, I ſay,
“ thus accompliſhed, happily interpo-
“ ſed, and ſaved this noble invention
“ from well-nigh periſhing in its in-
“ fant-ſtate; he likewiſe, at an early
“ period of life, had applied himſelf to
“ the improvement of the Teleſcope,
“ but imagining that Gregory's ſpe-
“ cula were neither very neceſſary, nor
“ likely to be executed, he began

"with proſecuting the views of DES-
"CARTES, who aimed at making a
"more perfect image of an object, by
"grinding lenſes, not to the figure of a
"ſphere, but to that of one of the conic
"ſections. Now whilſt he was thus em-
"ployed, three years after GREGORY'S
"publication, he happened to take to
"the examination of the colours form-
"ed by a priſm, and having, by the
"means of that ſimple inſtrument,
"made THE EVER MEMORABLE DIS-
"COVERY of *the different refrangibility*
"*of the rays of light*, he then perceived
"that the errors of Teleſcopes, ariſing
"from that cauſe alone, were ſome hun-
"dred times greater than ſuch as were
"occaſioned by the ſpherical figures of
"lenſes. This circumſtance forced, as
"it were, NEWTON, to fall into GRE-
"GORY'S track, and to turn his
"thoughts to reflectors. *The different*
"*refrangibility of the rays of light* (ſays
"he, in a letter to Mr. OLDENBURG,

“ SECRETARY to this SOCIETY, dated in *February*, 1672) made *me* take reflections into conſideration, and finding them regular, ſo that the angle of reflection of all ſorts of rays was equal to the angle of incidence, *I underſtood, that by their mediation, optic inſtruments might be brought to any degree of perfection imaginable*, provided a reflecting ſubſtance could be found, which would poliſh as fine as glaſs, and reflect as much light as glaſs tranſmits, and the art of communicating to it a parabolic figure be alſo obtained *. Amidſt theſe thoughts, I was forced from *Cambridge*, by the intervening plague, and it was more than two years before I proceeded further †.

---

* *By this letter of* SIR ISAAC NEWTON's, *it is evident to me, that he had taken notice of the poſſibility of producing what I humbly flatter myſelf I have fully accompliſhed. Read this great Philoſopher's* (NEWTON's) *letter a thouſand times, or* OFTENER, *if will bear it.*

† Phil. Tranſ. n. 80.

"But how excellent ſoever the contrivance was; how well ſoever ſupported and announced to the public; yet whether it was that the artiſts were deterred by the difficulty and labour of the work, or that the diſcoveries, *even of a* Newton, were not to be exempted from the general fatality attending great and uſeful inventions, *the making a ſlow and vexatious progreſs to the authors*; the fact is, that, excepting an unſucceſsful attempt which the ſociety made by employing an artificer to imitate the Newtonian conſtruction, but upon a larger ſcale, and a diſguiſed Gregorian Teleſcope, ſet up by Cassegrain abroad, as a rival to Newton's, *and that in theory only*, for it never was put in execution by the author *) no reflector was heard of for nearly half a century after; but when that period was elapſed, a re-

---

[*] Compare *Montucla, Hiſt. de Mathem.* 2 *t. p.* 647.

" flecting Teleſcope was at laſt pro-
" duced to the world of the NEWTO-
" NIAN conſtruction, which *the vene-
" rable author*, ere yet he had finiſhed
" his much diſtinguiſhed courſe, had
" the ſatisfaction to find executed in
" ſuch a manner, as left no room to
" fear, that the invention would longer
" continue in obſcurity.

" NEED I now ſet forth the merit
" of aſcertaining and advancing the
" conſtruction of the reflecting Tele-
" ſcope, to an audience ſo well appriz-
" ed of its value? To you who know
" that of all inventions, there are none
" ſo juſtly entitled to our admiration
" as thoſe which have been fallen upon
" for enlarging the powers of viſion;
" and that the diſcovery of optical in-
" ſtruments may be eſteemed among
" the *moſt noble*, as well as among the
" *moſt uſeful gifts* which the Supreme
" Artiſt hath conferred on man? For,

" all-admirable as the eye came out of " the hands of Him who made it, yet " no organ of the animal frame hath he " permitted ſo much to be aſſiſted by " human contrivance, not only for the " uſes and comfort of common life, " but for the advancement of natural " ſcience; whether by giving form, " and proportion to the minute parts of " bodies, (as it were to the atoms of " nature) imperceptible before, or by " contracting ſpace, and, as by magic " art, bringing to view the grander objects " of the univerſe, whoſe immenſe " diſtances had either diſguiſed their " aſpect, or rendered them quite invisible.

" Nor did this celeſtial commerce " ceaſe with the acquiſitions of Galileo, " but hath been extending ever " ſince the time that that great man " firſt turned his glaſſes to the Heavens. " The famous Kepler, on the firſt no-

"tice, embraced the diſcovery; and in "1611, the year following the SIDEREUS NUNCIUS OF GALILEO, "publiſhed a treatiſe of dioptrics, "geometrically explaining the performance "of the *perſpicilla*, and propoſing ſome "proper improvements of them. Then "came SNELLIUS, DESCARTES, and "other celebrated geometricians abroad, "who applied themſelves to Optics, "and ſucceſsfully cultivated that "fruitful branch of ſcience. But whilſt at "that period, in different parts of *Europe*, *men of the firſt rank* in "mathematical ſtudies, ſeemed to vie with "each other, in promoting not only "the theory of viſion, but the "mechanical practice of the inſtruments "appertaining to it, and particularly the "Teleſcope; how did it happen, that "in this country, in the laſt century, "which had ſo auſpiciouſly begun with "the lights derived from LORD BACON "and DR. HARVEY, we ſhould after-

" wards find few traces of any attempt " in that way, earlier than the eſtabliſhment of THIS SOCIETY? Of this " pauſe, in the courſe of your philoſophical diſcoveries, the diſtracted ſtate " of theſe KINGDOMS, under a long " civil war, was indubitably the occaſion; *for no ſooner had we ſheathed* " *the bloody ſword, and diſplayed the* " *peaceful olive,* than arts and ſciences " again ſprang forth, and with ſo much " vigour, *that the advancement made in* " *theſe lands, ſince that epoch, in Optics* " *alone, may be conſidered as one of the* " *nobleſt exertions of the human genius.* " Not to contend for a general ſuperiority in the publications *here* on that " ſubject, ſince the time that GREGORY " entered firſt into that grand career, to " ſilence all competition, I need but " mention the *Theory of Light and Colours*; a piece ſo excellent for invention, for judgment in conducting experiments, and for drawing the proper

" concluſions from them, *that had it been* " NEWTON's *ſingle work*, it would not " only have done laſting honour to him- " ſelf, *but to the country that gave him* " *birth*. And as to the inſtruments, " which of them, let me aſk, hath not " been either found out, or ſignally im- " proved among you? *or what nation is* " *there that hath embraced the arts,* " *and doth not value itſelf on poſſeſſing* " *every piece of this kind of* Britiſh " *workmanſhip*. The reflecting Tele- " ſcope I may call wholly your's, both " as to the original contrivance, and " every ſtep of its advancement, nay, " from its revival by MR. HADLEY, to " this day, a ſpace of nearly threeſcore " years, we have heard of no artiſt, out " of this iſland, who hath been able to- " lerably to copy, much leſs to add to " this ſplendid invention.

" WHAT acknowledgments then, " Gentlemen, do we not owe to our

" worthy brother, who, for above " twenty years paſt, in the uncertain " intervals of a toilſome and anxious " profeſſion, hath unbent his mind, " not in the periſhing recreations of the " world, but in inveſtigating, with un-" remitting diligence, *what had been* " *done, but concealed by others*, and in " making many *ſucceſsful experiments* " towards perfecting this inimitable " inſtrument. A liberal account of " theſe leiſure hours he hath laid be-" fore you, in his inſtructive paper; a " communication, I am perſuaded, that " will not only preſerve, but ſignalize " his name in your records, among " the very intelligent and ingenious " promoters of the great ends of your " inſtitution."

The *Syllepſis Optica* you may call wholly your's.
Tuum eſt, perſeverando,
Non ſibi, ſed patriæ, præſto et perſto.

ALTHOUGH for a while I was under the diſagreeable neceſſity of leaving my FRIENDS and opponents in ſuſpenſe, I have made the moſt of the time.

DURING MY RETIREMENT I have prepared myſelf with a work, *which I truſt will give ſatisfaction to my friends, and convince my opponents of their errors*, and I ſhall think myſelf *amply* rewarded, placing every confidence in the candour of the public, that the preference will be given me, conſidering it as my juſt claim and right to have ſome benefit from my diſcoveries and improvements, *and that I ſhall be properly ſupported* *, as my works ſhall appear deſireable and deſerving.

BEING CONFIDENT that theſe *my improvements* will be a ſubſtantial and laſting benefit to my native country, and happy, *on that account*, I made them, and for which (together) with the advice of ſeveral PERSONS of RANK, I was induced to petition PARLIAMENT * for a ſmall gratuity for diſcoveries, that before this time might have been of happy conſequence to my country, and pleaſure to lovers of the arts, *in whoſe countenance and ſupport* I truſt I ſhall meet encouragement in the publication of my *principles*, and ſale of my *works*, prior to my ſending them into any FOREIGN COUNTRY, which I have been ſtrongly ſolicited to do at any price, and ſubject to any reſtriction, even that of receiving them with my ſeal affixed to them, *and real ſecurity* given in *London* for a large penalty to be paid me, provided it ſhould be made appear, that their ſeals were broke open, or the inſtruments applied to uſe, until they were out of *England*.

---

* *In hoc ſigno vinces.*

---

* MY PETITION *to* PARLIAMENT *had the high honour to be preferred, and ordered to be referred to a* COMMITTEE, *for which I cannot ſufficiently thank* THE HONOURABLE HOUSE; *but ſome Gentlemen of* RANK, THROUGH MISTAKE, *unfortunately called upon me, without the leaſt notice, and ſaid,* THEY WERE APPOINTED *and authoriſed by* PARLIEMENT, *as* A COMMITTEE, *to ſee my* EXPERIMENTS, *and examine my* DICOVERIES; *but being informed by ſome of my friends,* PERSONS OF RANK ALSO, *who were then in the room* (*invited by me as a* SELECT COMPANY, *to ſee my experiments*) *that the Gentlemen were miſtaken, and that* PARLIAMENT *had not appointed a* COMMITTEE, *at which I was, like* KIRCHER's *Spectator, as* ſummo ſtupore defixus*, *and this is the true reaſon why I did not trouble* THE HONOURALE HOUSE any further.

QUERY, *Did* PARLIAMENT *ever appoint* A COMMITTEE *to examine into my* DISCOVERIES, *in conſequence of my petition?* *If in the* AFFIRMATIVE, I was miſinformed by my friends; *if in the* NEGATIVE, *the Gentlemen who perſonated* SUCH COMMITTEE, *at leaſt* were miſtaken.

* Kircher's Ars Magna, p. 2.

I have even been offered, by different people, one hundred guineas *for one* of the little fifteen-inch *Subſcription Teleſcopes*, and ſeveral times could have had one hundred guineas *for a pair of ſpectacles*, both to take abroad; but the high honour I have had conferred upon me, and the love of my own country, has hitherto prevailed over all pecuniary advantages, much as I have ſuffered to accompliſh an undertaking, once more ſubmitted to the candour of the public (*nec temere, nec timide*) by their

Very humble ſervant,

W. STORER.

Sero, ſed ſerio.

Data fata ſecutus.

THE Noblemen and Gentlemen, who conſtitute my COMMITTEE, are hereafter arranged in the form which they did me the high honour to ſign their names for that purpoſe, and who were then pleaſed to condeſcend to grant leave for the ſame to be inſerted in my plan, and on whoſe opinion and report I will ever reſt my cauſe, are,

John Pitt, Eſq;
William Codrington, Eſq;
The Duke of *Portland*,
Count de *Bruhl*,
William Lock, Eſq;
The Duke of *Mancheſter*.
Charles Gore, Eſq;
Henry Penton, Eſq;
Sir *William Codrington*, Bart.

Vincit omnia veritas.

TO THE

Earl of *Aylesford*,
Angerſtein,
Mr. *Arſwidſon*,
Earl *Bathurſt*,
Earl of *Bute*,
Lady *Caroline*,
Sir *Patrick Blake*,
His Excellency Count *Bruhll*,
Colonel *Burton*,
Right Honourable Lady *Bateman*,
Lady *D. Beauclerk*,
Wilſon Braddyl, Eſq;
Mr. *John Bateman*,
Godfrey John Boccius, Eſq;
P. W. Baker, Eſq;
Bathoe, Eſq;
E. Boehm, Eſq;
John Beard, Eſq;
Benjamin Barnet, Eſq;
Earl of *Clanbraſſill*,
Right Honourable General *Conway*,
George Cumberland, Eſq;

John Chicheſter, Eſq;
William Conſtable, Eſq;
Thomas Cornwall, Eſq;
William Codrington, Eſq;
James Chriſtie, Eſq;
Samuel Cutler, Eſq;
Charles Catton, Eſq; R. A.
Lord *Dudley*,
Peter Dalmea, Eſq;
Sir *John Eden*, Bart.
George Engleheart, Eſq;
The Honourable *Fitzmaurice*,
William Frankland, Eſq;
Richard French, Eſq;
L. D. Fytche, Eſq;
John Fuller, Eſq;
Lord *George Germaine*,
His Excellency Prince *Gallitzin*,
Charles Gore, Eſq;
Henry Goodwin, Eſq;
Leſlie Grove, Eſq;
Captain *John Graves*,
Earl of *Harcourt*,
Right Honourable Lord *Howe*,

Right Honourable Sir *William Howe*,
The Honourable *Hawke*,
Counteſs of *Harrington*,
Henry Hoare, Eſq;
Hearn, Eſq;
Hope, Eſq; *Amſterdam*,
Richard Harford, Eſq;
Joſeph Harford, Eſq;
Chriſtopher Hodges, Eſq;
John Harford, Eſq;
John Harman, Eſq;
Mark Harford, junior, Eſq;
John Hurlock, Eſq;
John Hale, Eſq;
John Hood, Eſq;
Robert Holford, Eſq;
Captain *Johnſon* of the *Granby*,
Ingleby, Eſq;
Jordan, Eſq;
William Jones, Eſq;
Lord Biſhop of *Killaloe*,
Richard Knight, Eſq;
Kynch, Eſq;
Captain *Knox*,

Francis Kinloch, Eſq;
Lady *Littleton*,
William Locke, Eſq;
F. Le Meſurier, Eſq;
John Le Meſurier, Eſq;
Peter Le Meſurier, Eſq;
Henry Le Meſurier, Eſq;
Thomas Le Meſurier, Eſq;
Lambert, Eſq;
James Lawrell, Eſq;
Miſs *Lane*,
Miſs *Leighton*,
Duke of *Mancheſter*,
Earl of *Macclesfield*,
Lord Viſcount *Mahon*,
Lieutenant General *Mackenzie*,
James Meyrick, Eſq;
Mr. *James Monro*,
Duke of *Northumberland*,
Captain *Joſeph Nunn*,
William O'Hara, Eſq;
Reverend Mr. *Oglander*,
Mrs. *Otway*,
Duke of *Portland*,

Henry Penton, Eſq;
Lieutenant General *Pitt*,
John Pitt, Eſq;
Phipps, Eſq;
Lady *Juliana Penn*,
William Pierie, Eſq;
Mrs. *Peacock*,
Lord *Rivers*,
Sir *Joſhua Reynolds*,
Captain *Robinſon*,
A. H. Rohan, Eſq;
Lady *Frances Radcliffe*,
Miſs *Ruth Raper*,
Earl of *S*.
Right Honourable Sir *Thomas Sewell*, Maſter of the Rolls,
Honourable Mr. *St. John*,
Schroeter, Eſq;
Charles Selwyn. Eſq;
De Schutdorf, Eſq;
Andrew Scherbinen, Eſq;
Sitwell, Eſq;
Lady *Frances Scott*,
Lieutenant Colonel *Trigge*,

John Trigge, Eſq;
Richard Troward, Eſq;
Captain *Todd*,
Urry, Eſq;
Mr. *Verwyck*,
Right Hon. *Agmondiſham Veſey*,
Mrs. *Vandewall*,
Sir *Watkin Williams Wynn*, Bart.
Honourable *Horace Walpole*,
Honourable *Thomas Walpole*,
William Weddel, Eſq;
Miſs *Wood*,
Benjamin Weſt, Eſq; R. A.
Reverend Mr. *Williams*,
Miſs *Watkinſon*, and to the NOBILITY, GENTRY, and THE PUBLIC in general; who have either purchaſed the ROYAL DELINEATOR, ſubſcribed to my exhibition of EXPERIMENTS, or to the POCKET TELESCOPE, *&c. &c.*

Manus juſta nardus.

LADIES and GENTLEMEN,

I think it incumbent on me to acquaint you, that you have hitherto been deprived of my Optical Diſcoveries and Improvements through the untimely interpoſition of a few ignorant or deſigning men, by whom *I fearleſs but honourably aſſure you you are miſled.*

IT WILL APPEAR, *on proper enquiry*, that I am able to perform what I have ſet forth from time to time in my printed propoſals.

THAT you are deceived by ſomebody, *is evident, I believe, to the whole world.*

YOUR patience in ſuffering *diſcoveries and improvements* (*which you have been apprized of to have been made in your own country*) *to lay dormant, becauſe a few ignorant or deſigning men ſay they are impoſſible*, is a perfect phœnomenon in *England*.

CONSIDER for one moment the utility of what I have offered, *and in which I* *ſo ſtrongly perſevere*, if it is a fit of the phrenzy I have been ſeized with, or if what I offer is the truth, *in either caſe I truſt in your wiſdom you will examine further*.

BRITONS *who* in ſo many inſtances have *nobly diſtinguiſhed yourſelves, and who value your country, ſo juſtly eſteemed for promoting and encouraging the polite arts*, I hope you will not ſuffer what I humbly offer as ſerviceable to mankind, to be any longer artfully concealed from you.

THE pleaſures and advantages which may be derived from my diſcoveries and improvements, by ſeeing more diſtinctly the remote and minute parts of the creation, *the immenſe richneſs of which, and the many other delightful effects of Optics*, cannot be even tolerably conceived *by thoſe unacquainted with great magnifying powers, added to ſufficiency of light for diſtinct viſion*.

PLEASE to recal to your memory, *the optical effects* I have had the honour to exhibit before *you, viz.*

THE *old Lady in the large Delineator.*

THE *effect of the ſword,* which I called *an indetermined focus.*

MICROSCOPIC views, *&c. &c.* alſo the effects of the *Principia Optica* exhibited at RICHMOND.

THE *bending* of the TELESCOPE, and yet preſerving by it, *diſtinct viſion, &c. &c.* not to enumerate the variety of Optical Experiments, *which you have ſeen me perform, and* WHICH *I am perſuaded you would find ſome difficulty in making others believe, who have not ſeen, or are unacquainted with their effects.*

WHAT I HAVE SHEWN *you,* ſome people perhaps have told you is impoſſible,

ſible, *even what you have ſeen,* AND WILL YOU BELIEVE THEM, *and be perſuaded from what you have been an eye witneſs to?* IF SO, *I muſt have done.*

YOU ESTEEM *the admirable ſenſe of ſeeing,* worth preſerving, and aſſiſting, and will you be diverted from the means of obtaining that bleſſing?

YOU HAVE TOLD ME *my diſcoveries and improvements on Optics,* WHICH YOU HAVE SEEN, *were deſerving your encouragement,* and indeed *you* have given me ſome proof that *you* meant ſo.

I am ſorry that ART, ACCIDENT and KNAVERY, *in conjunction with* IGNORANCE, have hitherto prevented *me* from furniſhing *you* with my Optical Works as I intended, *but you need not be any longer without them.*

I BEG *you* will reflect on what I have ſo earneſtly declared in my printed propoſals,

poſals, *you cannot then ſubmit any longer to be trifled with by the ignorant or envious part of mankind.*

YOU will not ſuſpect I have, or can impoſe a falſity on you, after having ſo amply experienced *your* encouragement on my *firſt* attempts, *a due ſenſe of which, emboldens me once more to aſſure you, you are miſled,* and that I am willing and *able* to make good *my part* to the utmoſt of my promiſes.

IN RECOMPENCE *to yourſelves,* for the ſatisfaction of *your country, and the public in general,* as well as *in juſtice to me,* I hope *you* will conſider of ſomething proper to be done, by which you may *firſt* advantage by my new diſcoveries and improvements on Optics.

I HAVE been frequently told by perſons of the *firſt* rank, that I might depend upon *proper ſupport* in ſuch degree,

gree, as it ſhould appear I was right. *Placing every confidence in ſuch high authority accordingly, I perſevered, and flatter myſelf, I have accompliſhed* THE DESIDERATA *foretold by Sir* ISAAC NEWTON, *in a letter, which cannot be read too often,* addreſſed to Mr. OLDENBURGH, Secretary to the Royal Society, dated in *February* 1672, "*The different refrangibility of the rays of light,* " SAYS HE, *made me take reflections into conſideration, and finding them regular, ſo that the angle of reflection* " *of all ſorts of rays, was equal to the* " *angle of incidence, I underſtood that* " *by their mediation* Optic *Inſtruments* " *might be brought to any degree of perfection imaginable, provided a reflecting ſubſtance could be found, which* " *would poliſh as finely as glaſs, and reflect as much light as glaſs tranſmits,* " *and the art of communicating to it a* " *parabolic figure be alſo obtained.*

" *Amidſt theſe thoughts I was forced* " *from* CAMBRIDGE *by the intervening* " *plague,*

" *plague, and it was more than two years*
" *before I proceeded further.*" *

Intervening plagues have alſo impeded *my Optical Purſuits*, and prevented my accommodating my *friends* and the public with my improvements in the manner, or ſo ſoon as I could have wiſhed, finding *how excellent ſoever* THIS IDEA *of* NEWTON'S *was*, *how well ſoever ſupported by* EXPERIMENT, *and announced* to the public, yet as the diſcoveries of even NEWTON, *were not exempted from the general fatality attending great and uſeful inventions, the making a ſlow and vexatious progreſs to the authors*; why then ſhould I wonder at any oppoſition that I have met with; or may meet, *from ſuch as have no other pretenſions, but to oppoſe or pilfer other men's labours, and take a merit to themſelves who never were able to advance or ſupport any hypotheſis of their own.*

---

* Phil. Tranſ. n. 80.

If through your lenity to me, leſt I ſhould be miſtaken, and that you waited to be *again* informed *from me*, I am the more honoured, and ſtill more in duty bound *to undeceive you*, I do it THUS PUBLICLY to advertiſe the world, that *inconſtancy and fear I ſcorn alike*. I have ſucceeded in my optical purſuits *far beyond my promiſes or expectations*, I therefore ſubmit to *your candour*, and truſt, that, in *your wiſdom*, *you will do me juſtice*, and you may immediately be in poſſeſſion of the optical diſcoveries and improvements *made by me*.

If I am *wrong*, I deſire it to be made known; *if I am* RIGHT, I truſt you will ſupport me, *as I rely upon you*.

I cannot doubt, but *thoſe* of the Nobility and Gentry, *who* deſire to encourage my great undertaking, will remit *to the bank of* HENRY HOARE, ESQ; AND Co. *Fleet-ſtreet*, *one Guinea*, *or* *or* WHAT THEY PLEASE, *as an acknowledgement of their intention to ſupport me,* and when the public ſhall be fully ſatisfied, *by my* COMMITTEE, *of the juſtneſs of my cauſe by* EXPERIMENT, *viz.* when it ſhall fully appear *to the* COMMITTEE, *in that caſe* the money remitted to the ſaid *bank* of HENRY HOARE, ESQ; AND CO. *ſhall be conſidered as* PART *of payment for a Teleſcope, Opera Glaſs, Reading Glaſs, Spectacles, or any other Optical Inſtrument, I have ſet forth in my Syllabus,* or in *part of payment* FOR THE PUBLICATION *of my new optical principles and improvements.*

THE money ſo remitted to the ſaid bank of HENRY HOARE, ESQ; AND CO. *there to remain, until I have performed my promiſe for which it is there depoſited; or ſhould I fail on my part, in that caſe, the money that may be ſo depoſited, to be returned, agreeable to the report and directions of my* COMMITTEE.

THIS *is only meant to aſcertain the ſupport I may expect from my own country,* ON CONDITION THAT I AM RIGHT, and that *my exertions may be agreeable thereto.*

THE HONOURABLE STUART MACKENZIE, in the preſence of ſeveral PERSONS OF RANK, did me the high honour to ſay, *he* would gladly preſent me with two hundred guineas, *out of his own pocket,* if I would ſhew him one fourth of what I had propoſed; ONE GUINEA, THEREFORE, cannot be an object to *thoſe* who wiſh to promote ſuch uſeful diſcoveries, as I pledge my honour and belief to have made or recovered; *and I humbly flatter myſelf I ſhall have the pleaſure to wait upon the* HONOURABLE STUART MACKENZIE, *for his generous promiſe,* which I ſhall be happy gratefully to acknowledge *by a capital inſtrument.*

I propoſe publiſhing my new diſcoveries and improvements on Optics *in ſingle*

ſingle ſheets, with proper experiments to facilitate the work, *at one ſhilling per ſheet*, and ſoon as *two hundred and fifty* of the preceding ſheet is ſold, *I will publiſh the next ſheet, if deſired by two hundred and fifty perſons, or to that amount*, and ſo on to the third ſheet, *&c. &c.*

THE work conſiſts of *about one hundred ſheets in quarto*, which will be delivered for *three guineas* TO THOSE who remit into the *bank* of HENRY HOARE, ESQ; AND Co. aforeſaid, *one guinea accordingly*, provided *one hundred engage, with leave to be drawn by me on the delivery of the whole work*, AND NOT BEFORE, and ONE SHILLING PER SHEET *to be paid as publiſhed, until forty-two ſheets are delivered.*

I could abridge the work exceedingly, even to one fourth, *were I not obliged to point out the abſurdities already committed*

mitted by others, in order to ſteer clear of *them*, and the better to familiarize *my* EXPERIMENTS and *ideas* on the *Deſiderata* of OPTICAL SCIENCE.

MY FIRST SHEET is, with great deference and ſubmiſſion, *addreſſed* TO THE KING's MOST EXCELLENT MAJESTY, and may now be had at MR. SIGRIST's, No. 218, PICCADILLY, and of MRS. JAGGER, *Norwich in Norfolk*, WHERE ORDERS will be received *for my ſecond ſheet*, or WORKS *at large*, and all letters, *poſt paid*, will be punctually attended to.

IT is with the utmoſt reſpect I preſent my thanks to the NOBILITY and GENTRY in and near *Norwich*, who have done me the honour to ſubſcribe to my *Syllabus*, &c. &c. and I aſſure them it was the high eſteem I held for many of the moſt reſpectable families in *Norfolk*, that induced me (in the early part of my diſcoveries)

diſcoveries) to ſend a card to acquaint THE REVEREND DOCTOR LLOYD, *Dean of Norwich*, that I believed I had made ſome optical improvements, and begged THE DEAN would do me the honour of ſeeing the *models* and *effects*.—Indeed I had conveyed them down from *London* on purpoſe; as I had a greater opinion of the taſte and judgment of THE DEAN and HIS LADY than any perſons at that time I knew in *London*.

I wiſh to return my ſincere thanks to PHILIP LORD BISHOP *of Norwich*, to SIR WILLIAM JERNINGHAM BART. and others of my friends in *Norfolk*, who I am informed did me the honour of a viſit *in Liſle-Street* at times when I was from home, or ſo engaged *with ſelect companies of the* NOBILITY, as to prevent my embracing the pleaſure of ſeeing *them*.

MY particular thanks are due to SIR HARBORD HARBORD, and Mr. COOK of *Holkham*, who were indefatigable in their attention to ſupport me as far as I found it neceſſary to proceed, until *ſome doubts* were cleared up, which appeared to me *through the miſtake of ſome gentlemen perſonating a committee*, but not appointed by *Parliament* as was ſaid, and which *alone* prevented my troubling the Honourable Houſe any further on a buſineſs in which my petition had been ſo highly honoured, fearing, through ſuch miſrepreſentation, a miſtake might happen through the whole houſe, eſpecially as I was told I ſhould be reported accordingly; for objecting to exhibit my experiments before ſtrangers, *who called upon me unawares, not appointed by* THE HONOURABLE HOUSE.

As no inſtruments or publications are to be conſidered or depended upon to be adjuſted by me, but thoſe to which I ſhall have ſigned my name as ſuch; and having the misfortune to be frequently afflicted *with the gout in my head or ſtomach (for ſeveral days together,)* I hope that *thoſe* who wiſh to have my *inſtruments* or *publications*, will give every indulgence *by the earlieſt notice of their intentions.*

SIR JOHN PRINGLE *obſerves, that, in a letter of* SIR ISAAC NEWTON'S, *that accompanied one of his inſtruments, which he preſented to the* ROYAL SOCIETY, *he writes,* "*That though he*
"*then deſpaired of performing that*
"*work* (to wit, THE PARABOLIC FI-
"GURE *of the great ſpeculum) by geo-*
"*metrical rules, yet he doubted not but*
"*that the thing might, in ſome meaſure,*
"*be accompliſhed by mechanical de-*
"*vices.*" *

AND it certainly was the effects of *a mechanical device*, that led *me* to conſider the ſubject to which the *above letter relates*, and which otherwiſe might have eſcaped my notice.

---

* Phil. Tranſ. n. 81.

IN another letter, written ſoon after, *he* tells the Secretary, "*That he was* "*very ſenſible, that metal reflects leſs* "*light than glaſs tranſmits*; *but as he* "*had found ſome metalline ſubſtances to* "*be more ſtrongly reflective than others,* "*to poliſh better, and to be freer from* "*tarniſhing than others, ſo he hoped* "*that there might in time be found out* "*ſome ſubſtances much freer from theſe* "*inconveniences than any yet known.* "Mean while here was," as SIR JOHN PRINGLE *obſerved,* "*another ſtop*; "and the more diſcouraging, as it "was not, like the former, to be removed by mechanical devices, nor "even by any chemical principle that "had been diſcovered." SIR JOHN PRINGLE *ſays further,* what is very "true, *that* "*That want could only be* "*ſupplied by making repeated trials*; "*nay, I may ſay as it were fortuitouſly.* "NEWTON, *therefore, laboured till he* "*found a compoſition that anſwered in* "*ſome*

" *ſome degree, and left it to thoſe who* " *ſhould come after him to find a better.*"

THIS PROVES, *that* SIR ISAAC NEWTON was aware that ſomething better, *one time or other*, would be diſcovered.

SIR JOHN PRINGLE obſerves, "HUY- " GENS was not ſatisfied with expreſſ- " ing to the Society his high approba- " tion of the late invention, but drew " up a favourable account of the new " Teleſcope, which he cauſed to be " publiſhed in the *Journal des Scavans* " of the year 1672, and by that channel " it was ſoon known over *Europe*."

And ſhall my ſuppoſed impoſſibilities or diſcoveries be firſt authenticated by the JOURNAL DES SCAVANS, *or the Gazette in* England ?

SIR JOHN PRINGLE continues " Mr. " HADLEY, *I am informed was not leſs* " *commu-*

" *communicative than he was ingenious,* " *being ever ready to impart his lights* " *to others; in particular I am informed, that he ſpared no pains to inſtruct* " MR. MOLYNEUX, *and the Reverend* " DR. BRADLEY, *and that when thoſe* " *Gentlemen had made a ſufficient proficiency in the art, being deſirous that* " *theſe Teleſcopes ſhould become more* " *public, they liberally communicated to* " *ſome of the principal inſtrument-* " *makers of this city, the knowledge they* " *had acquired from him**. Now ſuch " ſcholars, as it is eaſy to imagine, " ſoon advanced beyond their maſters, " and completed reflectors by other and " better methods than what had been " taught them."

THIS *is perfectly conſiſtent, and agrees with the opinions of* JOHN PITT, ESQ; LORD MAHON, *and others, who were*

---

* *Smith's* Syſt. of Opt. b. 3. ch. 2.

deſirous my diſcoveries, &c. *ſhould be purchaſed for the uſe of* OPTICAL INSTRUMENT MAKERS, *and the* PUBLIC, *and the advice lately given me, to conſider well before I publiſhed, leſt I ſhould give my adverſaries the advantage, by an opportunity to rival me, or, perhaps, exceed my inſtruments, if I diſcloſed my* NEW OPTIC PRINCIPLES AND DISCOVERIES *too haſtily*, juſtly obſerving, *that they abounded in money more than I did.* BY THIS, *the public will learn, that a little money to carry on my works, was the only thing needful*, and of courſe *the ſtopping the ſubſcription for my* POCKET TELESCOPE, (*which I was deſired to do*, in conſequence of a bill depending in parliament) *retarded the proſecution of my intentions, which, with the ſubſcriptions, I could have fulfilled in due time.*

SIR JOHN PRINGLE ſaid, he had been well informed, that Mr. SHORT poſſeſſed a grand ſecret in Optics, *but that it died with that ingenious* ARTIST.

I conclude Mr. SHORT was an experimental Philoſopher, *who in general wiſhes to avoid cavilling.*

SIR ISAAC NEWTON (*above an hundred years ago*) PRESAGED, *that the Public would one day poſſeſs a Parabolic Speculum, not accompliſhed by Mathematical Rules, but by Mechanical Devices.*

MY *Catadioptric Paralleliſm* appears to me *to produce an effect exactly what* NEWTON *preſaged as deſiderata*; and it gives me pleaſure, that the idea firſt occurred to me through *a Mechanical Device,* as SIR ISAAC *foretold would one day happen*; and I think I may now with ſafety pronounce, that I am able to demonſtrate the cauſe both *experimentally* and *mathematically*; but be the *latter* as it may happen, *the ef-*

fects which I have now again offered are firſt to be enquired after; *if they are worthy your notice, I am ready and willing to communicate my directions, to produce the ſame by* EXPERIMENT; *and as to their cauſes, I hope you will encourage me to give you my opinion of them alſo,* which, however, I only deſire ſhould be conſidered *as my opinion,* hoping, that you will abide by the reſult of *my Experiments,* unleſs by future Experiments you are convinced to the contrary.

IF what I have offered you (as the effects of the *deſiderata* preſaged by SIR ISAAC NEWTON) ſhould fall ſhort of the height of *that great man's expectations,* yet I can venture to aſſure you, they approach towards them in a more conſiderable degree *than is hitherto known, and their cauſes appear to me to be wonderfully ſimple, and I find that they may be extended to a much greater advantage*

advantage than I think it prudent at preſent to mention, but ſincerely recommend and ſubmit them to further enquiry, which there is great probability may afford many more new lights, that may tend to the accompliſhing the moſt uſeful and important diſcoveries, as I have ſeen cauſe to believe will one time happen to come to light, (and moſt likely) *through ſome accident, which (if Philoſophers will be generous, they muſt acknowledge) have done more towards the improvements of Optic Inſtruments, than the moſt accurate mathematical reaſoning*; therefore,

We ought not to deſpiſe or neglect the moſt trifling hint or improvement, although it ſhould be offered us by a NOVICE, *for Optics (at preſent) are inconteſtibly in their infant ſtate, notwithſtanding* YOU SHALL ADMIT FOR A MOMENT, *that I am able to produce all I have ſet forth.*

After what I have wrote, leſt you ſhould be at a loſs to determine what kind of Teleſcope I give the preference to, A REFLECTOR *or a* REFRACTOR, *I think it neceſſary to add, that I find the* REFRACTING TELESCOPE *is beſt calculated to admit and preſerve* MORE LIGHT WITH GREATER MAGNIFYING POWERS, *but that the principles upon which that inſtrument is* AT PRESENT *conſtructed by Mr.* DOLLOND AND OTHERS, *are remote from the* TRUE *principles of* OPTICS; *yet I* muſt however acknowledge, that Mr. DOLLOND's compound object glaſſes are an improvement, and very ingenious; *and, as Mr.* MURDOCH *obſerves, are the natural conſequences of* NEWTON's EXPERIMENT *; *but Mr.* DOLLOND's *ſpecification ſets forth no new principles, neither were the true principles of his own inſtrument known to him,* and is ſtill nevertheleſs complex and abſurd; *and how it came to happen,*

---

* PRIESTLEY's Optics, p. 474. Per VI.

that theſe things I have offered ſhould have hitherto eſcaped being taken proper and PUBLIC NOTICE *of by* OPTIC WRITERS *or* PHILOSOPHERS, *is to me a perfect paradox,* upon which I will make ſome further experiments, and expoſe to the Public, *wherever I find the cheat that deprives them of my improvements any longer.*

The METHOD of Philoſophiſing *.

" *As in Mathematics, ſo in Natural*
" *Philoſophy, the inveſtigation of diffi-*
" *cult things, by the method of analyſis,*
" *ought ever to precede the method of*
" *compoſition. This analyſis conſiſts in*
" *making experiments and obſervations,*
" *and in drawing general concluſions from*
" *them by induction, and admitting of no*
" *objections againſt the concluſions, but*
" *ſuch as are taken from experiments, or*
" *other certain truths: For hypotheſes*

---

* NEWTON's Optics, Query 31. page 380.

" *are not to be regarded in Experimental*
" *Philoſophy. And although the arguing*
" *from experiments and obſervations by*
" *induction, be no demonſtration of gene-*
" *ral concluſions, yet it is the beſt way of*
" *arguing which the nature of things*
" *admits of, and may be looked upon as*
" *ſo much the ſtronger, by how much the*
" *induction is more general. And if no*
" *exception occurs from Phænomena, the*
" *concluſion may be pronounced generally.*
" *But if at any time afterwards any ex-*
" *ception ſhall occur from experiments,*
" *it may then begin to be pronounced with*
" *ſuch exceptions as occur. By this way*
" *of analyſis, we may proceed from com-*
" *pounds to ingredients, and from motions*
" *to the forces producing them; and in*
" *general, from effects to their cauſes,*
" *and from particular cauſes, to more*
" *general ones, till the argument end in*
" *the moſt general. This is the method of*
" *Analyſis; and the Syntheſis conſiſts in*
" *aſſuming the cauſes diſcovered and eſta-*
" *bliſhed,*

“ *bliſhed, as principles, and by them explaining the phænomena proceeding from them, and proving the explanations.*”

Of the OPPOSITION which NEWTON's DOCTRINE, concerning LIGHT, met with.

“ *Conſidering how deciſive were the very firſt proofs, that* SIR ISAAC NEWTON *produced, in ſupport of his hypotheſis, concerning the different refrangibility of the rays of light, and the invariable colour of the differently refrangible rays, (though all the experiments I have recited, were not publiſhed to the world, till ſome time after, and he had not then acquired that diſtinguiſhed reputation which he afterwards gained by the publication of his* PRINCIPIA), *it is not eaſy to account for the violent oppoſition which his theory met with, and the vexatious*

" *diſputes which it occaſioned among Phi-*
" *loſophers, eſpecially as theſe diſcoveries*
" *were a real addition to what was*
" *known before concerning the ſubject,*
" *and were not merely the overturning*
" *of preceding hypotheſis. Indeed, as I*
" *have obſerved before, there was not*
" *then any hypotheſis about the matter*
" *that could be ſaid to be* eſtabliſhed, *or*
" *that was held in any degree of repute*
" *among Philoſophers. Beſides, the chief*
" *oppoſers of* NEWTON *were not per-*
" *ſons who had advanced any hypotheſis of*
" *their own, to which they could be ſup-*
" *poſed to be attached. But ſuch is the*
" *nature of man, that as ſoon as any per-*
" *ſon ariſes to any degree of eminence, the*
" *emulation of others is offended at ſeeing*
" *the rank in the eſteem of mankind, to*
" *which themſelves are puſhing, occupied*
" *by another, and one avenue more to*
" *diſtinction and fame ſhut up. Not be-*
" *ing able, therefore, to riſe into repu-*
" *tation by any opinions or diſcoveries of*
" *their*

“ *their own, they hope to make themſelves noticed by their oppoſition to thoſe of others. Our Philoſopher was ſo chagrined by thoſe diſputes, into which he entered with ſome degree of ſpirit at firſt, that, dreading to involve himſelf in more altercation, he could not be prevailed upon to publiſh his treatiſe on* Optics, *which he had promiſed to the world, till the year* 1704; *and that, contrary to his uſual cuſtom, in* Engliſh *only (which was a language very little known abroad in thoſe times) and with an earneſt requeſt, that no perſon would tranſlate it without his leave; and yet the principal of his diſcoveries concerning light and colours, were communicated to the Royal Society in* 1675, *and were publiſhed in the Philoſophical Tranſactions. Theſe and other inſtances of unexpected and unmerited oppoſition, contributed to make our author more reſerved, and more uncommunicative to the end of his life* *.”

---

* Priestley's Optics, vol. II. page 348.

And are not theſe vexatious diſputes ſufficient to deter any man from engaging in controverſy? which, like the dog in the fable, is only ſnapping at the ſhadow, and loſing the ſubſtance; IN THE MEAN TIME DO NOT FORGET *you loſe time, as the* ROYAL SOCIETY *did, by neglecting* NEWTON'S DISCOVERIES *above thirty years, an inſtance of an irreparable loſs, which I beg to remind you of.*

LADIES and GENTLEMEN,

IT is with the utmoſt reſpect for the high honours you have already conferred upon me, I beg leave to ſubſcribe myſelf, *as thankful for the truſt you have repoſed in*, and ever faithful to the confidence you may hereafter think proper to place in

Your moſt obedient
humble ſervant,

W. STORER.

Profeſſor of Optics to his MAJESTY.
Dieu defend le droit,
Tandem fit ſurculus arbor.

FINIS.

Signed W Storer

G.R III
BRITISH MUSEUM